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Research in Recreation

By George Hjelte

Superintendent of Recreation, Los Angeles

PUBLIC recreation has reached that stage of development in which research is recognized as an essential requisite to further growth. Recreation has now become an important concern of government for which large funds are being expended. Many expensive mistakes are being made because of the scarcity of factual information and recorded experience. Research is required to enable a better understanding to be had of the fundamental objectives of public recreation, the bases for formulation of recreation programs, the processes of leadership and guidance in recreation activities, and the efficacy of various forms of organization and procedure. Much of the research which is needed is of a highly specialized academic character which requires the services of specialists in several scientific fields. On the other hand much of it is of immediate practical nature closely related to administrative problems. To the extent that this is so research may be considered an important function of administration. Effective administration is not only concerned with the operation of an existing institution, according to established precedents, but also in the definition and re-definition of its functions, the improvement of its operations, the expansion of its services, and the adaptation of its work to changing needs. All well-established public recreation agencies conduct research from time to time, if not continually, and occasionally avail themselves of the research services of special agencies which are organized to provide research services.

RECREATION SURVEYS

The recreation survey is a product of research which cities and counties have found helpful in many ways. There have been many kinds of surveys in the field of recreation, each of which has had its own value and usefulness. There have been surveys of the leisure habits of selected groups and of whole communities. The National Recreation Association conducted an extensive inquiry into the leisure habits of 5,000 people. Another splendid investigation of this type was the study of leisure in a suburban community, Westchester County, New York, which was conducted by the Council for Research in the Social Sciences of Columbia University with the collaboration of the Westchester County Recreation Commission. There have been comprehensive surveys of cities to determine the nature of their recreation problems, or the solution to their problems of public recreation. Notable among these are the Recreation Survey of Buffalo, published by the Buffalo City Planning Association, the Survey of Recreation Facilities

in Rochester, New York, made by the Council of Social Agencies of that city, the Chicago Recreation Survey by Northwestern University and the Chicago Recreation Commission, and the Recreation Survey of New York and Environs by the Russell Sage Foundation. Surveys have also been made of the work of public recreation agencies or departments, and of their administrative organization. Departments themselves frequently appraise their own services and survey the work of a single institution or recreation center or the neighborhood which the center serves.

Recreation surveys vary not only in subject matter which they cover, and in their comprehensiveness, but also in their immediate purpose. Some are intended as an exhaustive compilation of relevant subject matter as a reference guide for technical students; some are intended only for popular use to inform the general public rather than the technical student or administrator; others are undertaken primarily to provide a basis for a definite recommended program which finds its factual support in the subject matter analyzed; still others are intended as a technical guide to the administrator. The content of any survey is determined by its anticipated use. For example, if it is intended to serve only as a guide to an administrator much information already known to the administrator may be omitted. If, on the other hand, it is intended for the use of technical students and the general public it must be comprehensive.

The comprehensive recreation survey should include detailed investigation under each of the following headings:

1. The geography and topography of the place.
2. The population.
3. Socio-economic factors affecting the population.
4. The physical resources for recreation.
5. Evaluation of existing recreation programs and agencies.
6. Typical recreation patterns of the community.
7. Diagnosis of important needs.

THE CONTINUOUS SURVEY

Efficient administrators conduct continuous surveys concerning the work of their agencies. They have definitely in mind all of the factors and information which affect the work and are continuously adding to their fund of information on these subjects. Much relevant information comes to the administrator in the routine of his work. A survey file in which such information can be placed for later reference, properly classified, is of practical value to the administrator. Even though the information is never formally transcribed in a document intelligible to others, and never published, it is of value to the administrator to the extent that he uses it as a basis for his own recommendations and planning. When necessary the information can be used to substantiate

recommendations when they are questioned. With these considerations in mind, some departments require that the staff at various centers make surveys of their neighborhoods or districts and furnish outlines as a guide to the staff.

APPRAISAL OF RECREATION SYSTEMS

Cities are often interested in appraising their recreation services in relation to standards which apply generally. In some fields of public work objective standards have been developed by which the work of cities may be compared. In public health work, for example, standards have been published by the American Public Health Association and cities are scored periodically in relation to numerous indices accepted by the Association as standards. This procedure enables a city to detect the probable weaknesses in its public health provisions and is also a stimulant for improvement. Public recreation has not reached the stage of development where authoritative standards can be set up. However, the National Recreation Association has compiled suggested standards for appraisal and has published them in tentative form.[1] So far they have not been widely used to compare cities but one large city, Los Angeles, used them in modified form to appraise the services rendered in various comparable districts. The appraisal was of assistance in furnishing a guide for the equalization between districts of the services of the recreation department and in providing an objective basis for recommendations for future development. The standards used by Los Angeles as adapted from the schedule of the National Recreation Association are given below. It should be stated that the standards applicable to land and structures have more basis in experience than those related to program. It should also be noted that the standards do not represent an ideal condition but have been roughly computed as a "yardstick" for convenient measurement. Doubtless as public recreation develops more valid standards will be possible of formulation.

Schedules Used by Los Angeles for Appraising Recreation Services in Twenty-three Districts

Land and Structures

A. Total acreage of publicly owned parks, playgrounds, athletic fields, libraries, school playgrounds, for community use, 50 sq. ft. per unit of population
   1. Children's neighborhood playgrounds, 10 sq. ft. per unit of population
   2. District play fields, 15 sq. ft. per unit of population
   3. Special areas
      a) Bathing beaches, capacity for 10 per cent of population
      b) Baseball diamonds, 1 per 25,000 population

[1] National Recreation Association mimeographed bulletin, *Schedule for the Appraisal of Community Recreation.*

c) Softball diamonds, 1 per 6,000 population
d) Tennis courts, 1 per 2,000 population
e) Golf courses, 1 (18 holes) per 54,000 population
f) Municipal camps, minimum of one

B. Community Center Buildings
1. Gymnasiums, 1 per 25,000 population
2. Auditoriums, 1 per 10,000 population
3. Club rooms, 1 per 5,000 population

C. Swimming pools, 1 pool per 50,000 population

Program Service

A. Playground Supervision, 1 Session (morning, afternoon or evening) per 15 population
B. Swimming Pool Supervision, 1 Session per 200 population
C. Scheduled Recreation Program
1. Physical activities, 1 period (organized on scheduled time for instruction or practice) per 15 population
2. Nature activities, 1 period per 200 population
3. Music activities, 1 period per 1,000 population
4. Dramatic activities, 1 period per 1,000 population

D. Community Center Program
1. Physical activities, 1 period per 50 population
2. Music activities, 1 period per 100 population
3. Dramatic activities, 1 period per 100 population
4. Arts and crafts, 1 period per 100 population
5. Social recreation, 1 period per 50 population
6. Rhythmic activities, 1 period per 100 population
7. Hobby activities, 1 period per 200 population
8. "Character Building" groups, 1 meeting per 200 population

Participation and Use

A. Playground Attendance (per year), 10 times population
B. Swimming Pool Attendance (participants only), 2 times population
C. Scheduled Recreation Program (participants only), 3 times population
D. Community Center Program (participants only), 3 times population

Finance

$3.00 per unit of population

NOTE: For each item to be scored a scale was constructed. The maximum number of points was allowed if under any item the standard mentioned above was attained. The services in recreation of all public departments were included in arriving at the total score under each head, i.e., Park Department, School Department, Library Department, and Playground and Recreation Department.

RESEARCH PROJECTS

Research Concerning Attendance.—1. Studies of total attendance at various recreation centers and events. Nearly all recreation departments require that attendance counts be made daily and that reports showing daily attendance be submitted either weekly or monthly. While

it is not practicable to have the daily attendance broken down very finely, limited differentiation is practicable; for example, the daily attendance may be differentiated as to morning, afternoon, and evening; as to sex; as to spectators and participants; as to routine play (i.e. "free play"); scheduled and special events. If the statistics thereby derived are systematically collated many comparisons between centers and events may be made. The effect of changing policies may be noted and to some extent the efficiency or "productivity" of staff in so far as the latter may be inferred from attendance. Graphs showing seasonal trends may be made and are found to be of considerable value.

2. Intensive studies of attendance by the method of sampling. For limited periods more specific information concerning attendance may be obtained. The sampling method, by which is meant the intensive study of limited data taken as a fair sample of the general condition, requires more attention to the task of recording data than can be afforded over a long period; moreover, the patrons of a recreation center will tolerate for a short period but not for long the annoyance often caused by solicitation of intimate information. The sampling method affords an opportunity to obtain a variety of information otherwise unknown including such things as the average duration of stay; the frequency of attendance for each person; the relative popularity of activities; the relative appeal of different apparatus; the distance traveled from home to the recreation center; the relative "pull" of different hours of day and night; the age groups served; nationality of patrons, the percentage of population of a given district served by the center and the frequency of attendance; the effect of various barriers such as traffic arteries, rivers, industrial zones, etc., upon attendance; effect of competing attractions; effect of variations in fees charged.

One city determined that its attendance at a regional recreation center was composed largely of non-residents by recording for a period the license numbers of the automobiles which entered the area. Another found that day to day attendance at municipal swimming pools and beaches correlated closely with the mean temperature published by the weather bureau and could anticipate the probable attendance by weather forecasts. The latter information aided in the assignment of staff.

The efficacy of playground programs and other matters have been inferred from studies of reasons for non-attendance of people within the district presumed to be served by the center. Such studies involved interviewing of a cross section of the population. Much has been learned also from studies of attendance at counter attractions including the nature and amount of street play.

In one suburban district the staff of a large playground with the aid of temporary personnel, conducted a house-to-house canvass of the entire district from which valuable information on the effectiveness of the playground in the community was ascertained.

Research Concerning Cost.—If a simple system of cost accounting is followed, much information of value to the administrator can be obtained especially when the cost accounting is interpreted along with statistics of attendance. The following are some cost studies that have been found useful:

1. Studies of cost of operation of each center and comparison of costs in terms of total attendance, area, facilities, personnel, etc.; cost of operation per unit of attendance; cost of class instruction in different activities; cost of general supervision of different types of playgrounds per capita of attendance; cost of maintaining buildings and areas; cost of landscape maintenance; cost of utilities such as electric power for various activities and for various types of installation.

2. Durability and cost of various facilities in terms of time and use, for example, surface, apparatus, fences, spring boards, towels, soap, swimming suits, balls, bats, gloves, etc.

3. Studies of cost of office procedures such as mimeographing, dictation, postage, printed forms, promotional printed matter.

4. Studies of employees' travel as to distance, time consumed, mileage cost, maintenance and operation of rolling stock, all in relation to return therefrom in service.

5. Studies of camp costs, including cost of counseling or supervisory payroll in relation to number of campers; salaries and wages of employees who prepare and serve food; cost of camp supplies; cost of meat, fruit, vegetables, and other food costs, all computed on the per meal basis. It is very important in camp administration to compute at frequent intervals the cost of food consumed. The summer camp season is so short that definite preparations need to be made for camp cost accounting in order that the tendencies may be known early enough to correct any conditions which require correction.

6. Studies of capital cost of providing land, buildings, and structures for different types of recreation centers all in relation to the use and service rendered.

Research Concerning Accidents and Safety.—A definite procedure for reporting accidents and information pertaining thereto is essential to enable studies to be made having as an object the prevention of accidents and minimizing personal and municipal liability therefor. Recreation departments frequently make continuous studies of the following types:

1. Classification of the nature of accidents and relative frequency of each type including fractures, abrasions, contusions, concussions, etc.

2. Studies of apparatus injuries revealing the apparatus in use when accidents occurred and the relative hazards presented by each type of apparatus. Such studies have been the basis for correction of faulty installations and elimination of the most dangerous apparatus.

3. Studies revealing the relative dangers of participation in various types of athletic games and contests. These studies suggest preventive measures for participants and spectators at athletic events.

4. Studies of places where accidents occur in swimming pools and on beaches. These studies are the basis for instruction to pool and beach guards as to where accidents are most likely to occur and what spots require special vigilance; also what locations on beaches are so dangerous as to prohibit swimming thereat.

Research Concerning Personnel.—Recording of information concerning training, experience, and other qualifications of recreation personnel and studies of work done by such employees are of assistance in selecting personnel, arranging for in-service training, assigning of personnel, and better understanding of the nature of the work to be done. Studies have been conducted frequently of the following types:

1. Job analyses. Employees for a given period are required to record the duties performed hour by hour. Forms are prepared on which are shown the standard tasks such as general supervision, instruction, counseling, program organization and planning, community contacts, and preparing reports. Places are also provided for description of other non-standard duties. These are analyzed as to duties performed and time consumed and general tendencies are noted. Similar studies are made of the duties of maintenance and clerical employees.

2. Analyses of training and experience of workers in relation to specific skills employed on the job. These have proved of assistance in indicating the skills which should be sought in selecting employees and in suggesting the nature of in-service training which should be provided.

3. Rating systems. Several systems for rating the work and value of employees have been devised. They are difficult to apply to employees whose work does not lend itself to objective measurement but within certain limits they are helpful in systematizing the appraisal of employees and in emphasizing the relative value of qualities which contribute to success.

The research projects which have been listed are merely suggestive of the kinds of information of which the public recreation movement stands in need. These researches are of the simplest sort requiring no highly developed research techniques in the social sciences. Nearly every recreation agency is competent to conduct some research on this plane which will not only produce information for immediate practical use but also an attitude and habit of scientific approach to administrative problems. The more deeply involved problems of value and objectives remain the special province of sociologists and others detached from administration and specially trained in the more complex techniques of the scientific investigator.

Physiological Data Significant to Participation by Women in Physical Activities

By Frances A. Hellebrandt and Margaret H. Meyer
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1. The Behavior of the Depleted Organs During Exercise

THERE is relatively little in the vast and rapidly growing literature on the physiology of exercise which will specifically answer questions concerning the fitness of women for participation in competitive athletics. The major issues are two in number: first, the effects of physical activity upon the reproductive functions, and second, the wisdom of competition. But few observations have been made in natural sport situations. Indeed, the problem is hardly amenable to direct attack, so variable is the human machine in its reactions to athletic competition, and so complex the technic by which functional states may be reliably measured. The latter cannot be easily applied without totally disrupting the psychological concomitants of realistic athletic competition. This does not mean that the rich literature on the physiology of exercise is inapplicable to the study of the effects of participation by women in athletics. Many sound generalizations may be made from fundamental demonstrations which depend upon participation in repeatable laboratory exercise, controlled as to severity and duration. In recognition of this principle, the American Association for Health, Physical Education, and Recreation invited us to present in summary the recent researches of the Laboratory of Physical Education Physiology at the University of Wisconsin. This was done before the Section on Women's Athletics at the last national convention of the American Association for Health, Physical Education, and Recreation. Because of the practical consequences of emotional stress, with which, unlike laboratory exercise, natural sport situations are almost invariably associated, its theoretical implications are presented even though there is meager evidence to draw upon from human experimentation. Similarly, a few general remarks are appended relative to exercise policies during menstruation. Revolutionary changes have taken place in our

Paper presented by Margaret Meyer before the American Association for Health, Physical Education, and Recreation, Atlanta, April 1938.

understanding of the endocrinology of this important function and we must bring practical programs into harmony with recent theoretical advances.

The major problems under investigation in this laboratory during the past eight years have concerned themselves with the behavior of the so-called depleted organs during physical activity. It has long been known that blood is shunted away from the visceral area into working muscles and skin during exercise. The question which naturally arises is whether this deprivation embarrasses the functioning of the parts temporarily depleted of their normal blood supply. Empirical rules of hygiene have arisen because of the apparent logic of the assumption that these vasomotor shifts impair visceral function. Our attention has been drawn especially to two organs, the stomach and the kidneys.

Without exception the subjects of these investigations have been young adult women, professional students in physical education and by virtue of that criterion probably classifiable as above average in health and vigor. All of the observations were performed on relatively small groups of experienced subjects, meticulously trained to withstand the rigors of each procedure. Viscera are susceptible to rapid alterations in function as a result of psychic factors. Hence subjects must be carefully chosen. Many physiological procedures are too complex to be applicable to mass experimentation. Unless the observations are minutely quantitative, it is indeed rarely necessary to do this. There is nothing haphazard about Nature in her physiological manifestations. Rather, ample evidence of a high degree of constancy in the *trend* of the responses of *normal* individuals to *identical stimulation.* It has been said that Nature cannot be easily circumvented. Our own experiments have been concerned with grossly repeatable alterations in behavior.

The exercise studied has been of three types, which in general correspond to the activity recently classified by Dill [6] * as moderate exercise, hard work, and maximal anaerobic work. Use has been made of a variety of ergometers: the rowing machine, tread mill, Prony brake bicycle ergometer, Prony brake hand ergometer, and in particular the electro-dynamic brake bicycle ergometer, an instrument which permits great precision in the control of speed, load, and rate of working. (Kelso and Hellebrandt, 1934.)[22] To insure the performance of maximal work, boredom and stereotyping were eliminated by the administration of a battery of exercises, alternating predominantly arm and leg movements. The steady state is never attained and the subject ends the bout exhausted. Activity of this severity is rarely experienced in sports as *ordinarily participated* in by the average young adult woman and thus serves to test the function of the machinery of the human body under conditions of peak strain probably exceeded only under the added

* Refer to numbered Bibliography at end of article.

impetus of emotional excitement. Little could have been accomplished in the solution of the problems undertaken had not the subjects been willing, when the occasion demanded, to give to them their last ounce of strength. Much could and perhaps should be said about the heroism of the laboratory worker. It takes courage to have a needle thrust into the belly of a muscle for the determination of tonus; patience to stand with the eyes closed for an hour; fortitude, to hang motionless by the head, suspended in a tank of water; a sense of humor to be willing to swim with a stomach tube *in situ*. Such has been the devotion of the Wisconsin professional student to the science of physical education, and it must be obvious that mass experimentation of this nature is as impossible as it is unnecessary in the detection of the trends of physiological behavior.

THE INFLUENCE OF EXERCISE ON THE DIGESTIVE WORK OF THE STOMACH

The influence of exercise upon the digestive work of the stomach may be due to one or both of two factors. It may be the consequence of the vascular and physico-chemical changes associated with the muscular activity itself, or it may be the consequence of the emotional stress which is inseparable from many forms of severe exercise. Our preliminary attack upon this problem was very simple (Hellebrandt and Miles, 1932).[16] An Ewald meal of tea and toast was administered to a fasting subject. One hour later a small, flexible stomach tube was swallowed, the full gastric contents were removed in a single aspiration and analyzed for free and total acid, the constituents used in clinical medicine for the assay of gastric function. The subject did measured work for an hour preceding the administration of the meal or during the interim between its ingestion and the aspiration of the gastric contents. Exercise immediately *after* the ingestion of the meal had a moderately depressing influence. The same work performed *before* the ingestion of the meal was moderately stimulating. When the exercise participated in was pushed to the point of exhaustion, its influence was distinctly depressing.

We happened to have in the laboratory at this time a group of women who were to participate in a competitive game with which there was associated by tradition much emotional excitement. Tea and toast were substituted for the "spread" which preceded the competition. This game had a markedly depressing influence upon the acidity of the gastric contents. From these preliminary observations we concluded that moderately severe exercise has relatively little influence upon the acidity of the juice secreted in response to an Ewald meal, that protracted exercise is not necessarily depressing, but that exhausting work is associated with a diminution of the acidity of the gastric secretion to a level significantly below resting normal, and that the decrease is

particularly great when the exercise is accompanied by emotional excitement.

At this time we made an incidental observation, the study of which occupied our attention for a considerable interval subsequently. One subject rode the bicycle ergometer for an hour after the ingestion of an Ewald meal on ten different days. When these successive trials were graphed against the free hydrochloric acid in the gastric contents and a straight line fitted by the method of least squares, we noticed that the tendency was unquestionably for the exercise to have less and less effect as the procedure was repeated. The stomach seemed to be learning that it could continue its functioning in spite of a concomitant generalized exercise which was fairly severe and protracted. By the tenth trial, the acidity closely approximated the resting normal.

Before pursuing this lead further, our observations were extended to include additional aspirations, since we could learn considerably more if we resorted to the method of fractional analysis. (Hellebrandt and Hoopes, 1934.)[15] A Boas meal of 500 cc. of oatmeal gruel was either swallowed or administered through a stomach tube under gentle pressure to avoid contamination with saliva which was continuously removed by suction. The stomach tube remained in place throughout the course of the experiment which lasted from one to as long as 17 consecutive hours. (Hellebrandt, Tepper, Grant, and Catherwood, 1936.)[18] Samples of the gastric contents were withdrawn for analysis at regular intervals. Observations were extended to include the motor behavior of the stomach. This was accomplished in two ways: first, by studying the emptying time fluorescopically after the ingestion of a standard meal made opaque to X-ray by mixing 250 grams of barium sulfate into a thick porridge of farina (Hellebrandt and Tepper, 1934),[17] and secondly, by recording intragastric pressure changes associated with peristalsis (Hellebrandt and Dimmitt, 1934).[14] The subject swallowed two stomach tubes which had been cemented together. Through one the test meal was introduced and gastric samples withdrawn. A balloon of delicate condom rubber was attached to the other.

Through this second series of experiments we came essentially to the same conclusions. In order for exercise to affect gastric function, either secretory or motor, it must be very severe. The depressing influence was always transitory. Secretion was partially inhibited for 45 minutes or an hour, after which the stomach went about its work in a reasonably normal way. The same seemed true of emptying time, the lag during the first hour being made good by an accelerated emptying during the second hour, so that the final emptying time was not much prolonged. The initial failure to empty was at times very striking. The area of the stomach shadow one hour after a meal associated with maximal or hard work was larger than it had been immediately following its ingestion. Emptying occurred at an accelerated rate during

the second post-exercise hour, so that 120 minutes after the beginning of the observations, the relative size of the shadows was not much different than normal.

We again observed that with repetition a depressing bout of exercise soon lost its inhibition (Hellebrandt, Baernstein, and Hoopes, 1934).[10] This did not seem to be, strictly speaking, a training effect. In its usual sense that term implies the development of adaptations facilitating the performance of work as a result of *systematic, long-repeated exercise.* (Steinhaus, 1932.)[30] We observed that the inhibition vanished after only a *few trials,* even though the work was superimposed at long and irregular intervals upon the strenuous activity program of subjects inured to much exercise. We turned our attention, therefore, to the study of the mechanism of this phenomenon. We found that in spite of exercise violent to the point of prostration, gastric function proceeded unimpaired and obtained striking evidence that the mere contraction of muscle and the vaso-motor shifts associated with generalized exercise are in themselves powerless to suppress gastric function in a tube-trained and conditioned subject. We had assumed that digestive work was temporarily held in abeyance because of splanchnic deprivation of blood. Our results could mean only one of two things: either blood was not diverted away from the visceral area in significant volumes, or if it were shunted to the muscles and skin as seemed inevitable, the visceral parts concerned must be relatively insensitive to transient oxygen want. The next step, therefore, was to put the oxygen-want hypothesis of exercise inhibition of gastric function to the experimental test.

The organism as a whole was subjected to anoxemia of the precoma type (Hellebrandt, Brogdon, and Hoopes, 1935b).[12] This grade of oxygen-want was maintained for half an hour, during which the subject was just on the verge of consciousness. The effects on gastric secretion were negligible. We were forced to conclude from the evidence gathered that the ability of the stomach to secrete a juice of good acid content is relatively unimpaired by oxygen deprivation which widely suppresses the activity of the cerebral cortex and comes close to paralyzing the vital centers. The influences of oxygen-want upon hunger and digestive contractions were similarly slight. The findings suggest that the paralysis of gastric function, which we observed as an early and transient effect of repeated exercise, cannot be due solely to visceral anemia in consequence of the shunting of blood into active muscle and skin regions during the performance of physical work. This conclusion is a reasonable one, for it would indeed be disastrous to the efficiency of the gastro-intestinal tract if the vaso-motor shifts of exercise were able to inhibit its ability to function under any but most crucial emergency situations. Breakfast requires three or four hours for its digestion. It may take five or six hours before that part of the breakfast first evac-

uated into the duodenum traverses the length of the small intestine. By the time the last of breakfast leaves the stomach, luncheon takes its place. During the waking hours the gastro-intestinal tract of one who eats three meals a day is never empty. Although the stomach is only periodically loaded with foodstuffs, it keeps the intestine much more constantly supplied. Furthermore, what happens to an ingested meal while it remains in the stomach does not begin to compare in importance with what goes on in the small intestine. If exercise diverts blood away from the stomach, it also diverts it away from the intestine. If such diversion impairs digestive function, we must bar exercise *before, after, and between meals.* Nature would be wanting in wisdom if she constructed the human machine upon any such plan, and we are naïvely dogmatic when we teach that a rest of two hours after a meal is the imperative prelude to safe indulgence in exercise.

It is everyday experience that the initial reaction to a strange situation calls forth a diffuse response and a generalized type of behavior. That the viscera share in this is very probable. Suppression of the stomach, when it occurs, is probably due to the irradiation of nerve impulses into unnecessary pathways (Hellebrandt, Brogdon, and Hoopes, 1935a).[11] We have suggested that when suppression of gastric work does occur, it finds its chief cause in direct secretory and motor inhibition by way of the sympathetic division of the autonomic nervous system. How the viscera learn that such irradiation is unnecessarily protective is as yet in the domain of speculation. The fact remains that we cannot explain exercise suppression of gastric function by a blood diversion hypothesis alone. It seems that the stomach must have what may be called a large "margin of safety," the ability to continue working optimally under conditions which seem unfavorable to normal functioning. This thesis is biologically sound. Processes as fundamental to existence as nutrition cannot be susceptible to too ready change.

POST-EXERCISE ALBUMINURIA AND "WATER INTOXICATION"

It has long been known that violent exercise is associated with modification of kidney function. The urine becomes more acid. Its excretory rate is diminished. There may be complete cessation of urine formation. Abnormal constituents appear in the scant post-exercise secretion. These include sugar, lactic acid, albumin, red blood cells, and tube casts. We examined the post-exercise urine of 47 young adult women for albumin following experimental bouts of physical exertion of various types (Hellebrandt, 1932).[9] Of those who had no albumin in the urine before exercise, physical work produced albuminuria in 57.5 per cent and its severity was roughly inversely proportional to its frequency of occurrence. Subsequently we demonstrated an etiological relationship between the speed of doing work and the incidence and severity of post-exercise albuminuria (Hellebrandt, Brogdon, and

Kelso, 1932).[18] In some unpublished experiments Fosse noted that protein appeared in the urine much more frequently after match games in basketball participated in by secondary school girls than after practice periods or regular class work in physical education. It occurred most readily in girls with a low Schneider index of cardiovascular efficiency. The practical implications of these findings are obvious. Do such repeated insults impair the functional competence of the kidney? Until it has been conclusively demonstrated that post-exercise albuminuria is benign, this manifestation of a disturbed function which is highly characteristic of nephritis should not be dismissed too lightly. It behooves us to discover how frequently albuminuria occurs after participation in exercise programs as administered at various age levels.

It is common experience that the ingestion of large quantities of water stimulate the excretory rate of the kidney. Under even moderate intake this may be augmented to a level 15 times normal. All or part of the ingested fluid is recovered as urine, depending upon the adequacy of the previous hydration of the degree of "tissue thirst." There has been recent interest in a phenomenon first called by Rowntree (1926)[26] "water intoxication." The indiscriminate intake of large quantities of water following exercise associated with excessive sweating may lead to nausea, vomiting, and profound prostration, terminating in convulsions and death in animals subjected to extreme water loads. We have demonstrated in a long series of experiments on young adult women that hard or maximal work ranging in variety from violent rope-skipping of very short duration to competitive field hockey suppresses kidney function profoundly for 45 to 60 minutes (Hellebrandt, Walters, and Miller, 1936).[19] It occurs whether exercise precedes or follows the ingestion of water, and whether fluids are taken in single or divided doses. The oliguria is always profound, the rate of urine formation subsiding to a minimal level irrespective of the height to which function has been stimulated at the moment exercise is introduced. No forcing of water will break through this inhibition of kidney function. The excess of water is held in the tissues, leading, if accumulation is great, to distressing "intoxication." Diuresis is eventually resumed. The water temporarily retained in the tissues is eliminated in an entirely normal way, the peak excretory rate during the delayed response at times even exceeding that achieved at rest. Thus we see that the kidney responds much as the stomach does under conditions of physical stress. However, we have observed no "visceral learning" of the type demonstrated so admirably by the stomach upon the repetition of exercise. This probably never occurs because the deviations in kidney function are merely an expression of alterations in glomerular filtration and permeability explicable in terms of the physico-chemical changes induced by maximal work from which full recovery is relatively slow.

There is a strong and abiding bond between physiology and phys-

ical education. No matter from what point of view or for the fulfillment of what objectives exercise is administered, *it always has physiological effects*. These may be beneficent. Not infrequently they have no physically measurable derivatives once the acute effects of exercise participation have subsided. They occasionally do irreparable harm. Perhaps the most valuable by-product of the series of problems reported has been their influence upon the professional attitudes of the students who have shared in their solution. They have taught at least this small group that the recitation of empirical rules governing the hygiene of exercise has no place in the armament of the prospective teacher; that precepts steeped in tradition are susceptible to fundamental experimental attack through the utilization of tools at the disposal of any well-trained student; that physiology is not a remote science, but one of intense practical value to all who work with the living machine; that with its aid, physical education can be more easily practiced as a science, thus enhancing its utility to mankind.

2. Emotional Stress, Its Utility and Disadvantages

Emotion enables a man to extend his range of physical exertion incredibly beyond normal limits. Masses of unimpeachable evidence and innumerable records of heroic experiences substantiate this curious phenomenon. Emotion powerfully supplements coordinating processes ordinarily at work during exercise. Under its impetus great physical demands may be met. The extraordinary display of energy with which the desire to excel is associated is familiar to the physical educator. Realizing that the reinforcement of emotional stress is serviceable, he may deliberately provoke its arousal in ways graphically described by Cannon (1929).[4] Prodigious feats of strength and endurance may result.

Cannon has been responsible for the elaboration of the neurohumoral hypothesis postulating the coadjuvancy of adrenin and stimulation of the sympathetic division of the autonomic nervous system, whereby the cooperative mobilization of energy is quickly achieved in response to emergency situations. Sugar is thrown into the blood. The heart rate accelerates. Blood pressure rises. The bronchioles dilate. The spleen constricts. The gastro-intestinal tract ceases its functional activity. Fatigue vanishes. The sympathico-adrenal system calls into action a widespread, integrative response of obvious utility to a machine whose integrity has been threatened by excessive demands.

Emphasis has always been placed upon the purposive nature of these physiological manifestations. But practical experience often demonstrates that emotional stress may be disruptive to the nicety of balance between demand and response upon which sports requiring great skill depend. The performance of acts which require discriminat-

ing judgment and fine neuromuscular skill may be profoundly deranged. The correct pattern of response which has been painstakingly individuated by training is suddenly lost as impulses overflow into a multitude of unnecessary pathways. Bursts of speed may be too great for the materials of which the physical machine are made. The factor of emotional stress probably adds significantly to the incidence of injuries in competitive athletics by virtue of the violence of the effort it motivates and the loss of discriminative reactions with which it may be associated.

Emergency states are under the control of a central mechanism which resides in the phylogenetically ancient part of the brain normally held in restraint by the superimposed cerebral cortex. With few exceptions, sensory impulses from the periphery, exteroceptive and proprioceptive, pause in a subcortical relay station located in the thalmus, from whence fresh neurons course toward localization areas in the shell of gray matter which covers the telencephalon. Although the cortex is the site of emotional consciousness, affective states of thalmic origin have been observed in the presence of lesions which separate the new from the old brain. These are characterized by an exaggeration of emotional moieties. Inhibitive cortical influences normally prevent the primitive diencephalic centers from dominating human behavior. Experimental and clinical observations show that subcortical centers can seize control of the neuromuscular machine when the normal check of higher centers is released. Violent, stereotyped, primitive reactions are called forth by the mildest stimuli.

No one who has himself laboriously perfected some intricate neuromuscular act dependent for success upon minute perfection in timing, precise balance, and exact control can imagine emotional excitement an adjunct to skill. Although the drives which motivate competitive sports may be primitive, their execution is inseparable from recently acquired elements of judgment, exactness, and restraint. There seems to be little doubt that, under emotional stress, subcortical centers seize and drive the machine. Primitively purposive, the reactions aroused do not necessarily subserve desirable ends in the pursuit of learned activities.

Physiologists classify the responses under discussion as "release phenomena." The application of this concept of emotional stress to problems of exercise supervision has been largely ignored. Women are probably more liable to overexcitement than men. The mature are less easily aroused than the adolescent, though this is in part dependent on temperament. Many girls and some women never make good competitors. To a certain point emotional excitement is advantageous to the exercising machine. Extremes of emotional stress may, however, disrupt the delicate cardiovascular-respiratory adjustments and neuromuscular coordinations upon which athletic skills depend. There is real

danger of fatigue beyond reason. During artificially augmented states of stress, prudence is forgotten and sensations which normally stop exercise are disregarded. The judicious supervision of the competitive athletic programs of certain personality types and age groups requires inordinate tact, caution, and understanding.

EXERCISE POLICIES DURING MENSTRUATION

Time does not permit more than a brief allusion to exercise policies during menstruation. The endocrinology of periodicity and the unfolding of the details of the pituitary-ovarian relationship form one of the most brilliant epochs of modern biological science. We have turned away from citations of menstrual symptoms and statistical recitations of the frequency of incapacitation of women for physical effort during the menses. The anatomist, physiologist, zoologist, and biochemist have united forces in a gigantic endeavor to delimit the mechanisms which control reproduction. The half-century-old wave theory of menstrual molimina is being revived on a fresh basis with interest centered not on the ebb and flow of pulse rate, blood pressure, and body temperature (Mary Putnam Jacobi, 1877),[21] (Leta Hollingsworth, 1914),[20] (Hazel Elizabeth Eggleson, 1924),[7] but rather, on the cyclic interrelationships of the endocrine hierarchy responsible for recurrent changes in physiological behavior (Corner, 1922),[5] (Novak, 1930).[25] The newer hormone physiology suggests on a priori grounds that wave-like augmentations and depressions of the functioning of the organ systems of the female may be logically anticipated. However, from the findings of numerous researches (Bilhuber, 1927),[3] (Sowton, 1928),[29] (Bedale, 1928),[2] (Grollman, 1931),[8] (Scott and Tuttle, 1932),[28] (Kirihara, 1932),[23] the conclusion has been repeatedly reached that the menstrual function has insignificant effects on practically all physiological phenomena thus far studied. The *machine* is as fit for exercise at this time as at other times of the cycle. The menstrual effects on general behavior do not exceed in magnitude those to which women must constantly adjust in the course of the irregularities of everyday modern living. In the vast majority of cases, cyclic changes in function fall within the limits of the generous margin of safety under which all organ systems function. Womankind through the ages would hardly have been able to discharge her share of the physical burdens of existence were this not true. Her survival without obvious deterioration gives credence to this view.

From observations on lower forms, physical activity during critical phases of the reproductive cycle is apparently not unphysiological. During heat the ovarian hormone estrone is at its height. It produces great vascular changes in the reproductive tract and stimulates to excited activity (Bilhubar, 1927),[3] (Markee, 1932).[24] This is not in consonance with prevalent ideas on how an animal should behave during so

important an epoch. It is not at all uncommon to be confronted with a concept of reproductive physiology which visions the blood shunted to and from the genital tract as a result of vasomotor shifts in blood supply every time exercise is indulged in. Yet we see that the urge to activity makes itself felt in animals at a time when the whole reproductive tract is at the height of its vascularity. Obviously it would be unbiological to think that the very changes associated with fruitful mating should at one and the same time be detrimental by virtue of diversion of blood away from the reproductive tract and into the muscles. The vasomotors are of inestimable value in the economical distribution of blood demanded by varying relative needs of different tissues, but here we have in addition a *local mechanism* preventing such uncertainty in blood supply. The hormonal control of the blood supply of the reproductive tract must be dominant. Bartlemetz (1937)[1] has shown that the vascular distribution to the uterine mucosa is unique in several respects. It contains specialized tissue susceptible to a specific blood-born substance in a way which beautifully explains the mechanism of the periodic ischemic crumbling of the uterine mucosa and its rapid regeneration.

There is no scientific, objective evidence that exercise influences the cyclic changes which occur in the uterine mucosa. The lining of the uterus is already thick and vasuclar by the time ovulation occurs, which is approximately the fourteenth day of a 28-day cycle. It maintains this thickness and vascularity during the post-ovulatory phase of the menstrual cycle. It has recently been demonstrated that the endometrium begins to collapse before the bleeding of ovulatory menstrual cycles actually commences (Bartlemetz, 1937).[1] The uterine lining may be less gorged with blood and glandular secretion at the onset of menstruation than during the immediately preceding days. If we believe exercise detrimental when the uterus is "heavy" with blood, we must bar it from the fourteenth to the twenty-sixth or twenty-seventh days of each cycle!

Indirect evidence such as we now have is in favor of the continuance of exercise as a sane régime for the normal female during the menses (Sanderson-Clow, 1927).[27] This policy, put into effect in England by the Council of the Medical Officers of Schools Association, has met with approval. It has been associated with a marked reduction in the incidence of dysmenorrhea (Sanderson-Clow, 1927).[27] Not only does it seem physiologically normal to continue exercise during menstruation, but large scale experience with this policy as a mode of conduct for adolescent and young adult women has demonstrated it to be an intelligent prophylactic.

THE DESIRE FOR FITNESS

Perhaps we take too seriously the supposed effects of the exercise programs we administer. Exercise is rarely vigorously and systemati-

cally enough participated in by the average woman to achieve the trained state. The trained state is desirable when there is a premium on superfitness, when it is vital to race or nation to meet unusual physical stress. For ordinary life as the average American woman lives it, the reserves in the untrained state are great enough adequately to meet physical demands. Exercise is a part of daily living. Few normal, healthy, vigorous people confronted with the necessity for self-sustenance are really sedentary. Such exercise as is inevitable keeps mankind fit for the ordinary demands of ordinary living. It is only in the meeting of unusual physical situations that the average individual compares badly with the trained man. But the occasions demanding superstates of physical fitness for survival are so rare that to keep rigorously trained to meet them is a program perhaps wanting in intelligent direction. In other words, the superfitness of the trained state is a luxury which relatively few discipline themselves to attain in the absence of emotional drives like the tremendous exercise programs of certain European countries, preparing people of both sexes at all age levels "for labor and defense." We find universal participation in physical exercise and emphasis on fitness motivated by patriotic fervor when the preservation of a national group demands universal fitness. The physical education program and the athletic participation of the average American woman have less serious implications. They are overwhelmingly recreational, being practically never associated with the achievement of a trained state. Their physiological effects are probably mild and transitory. No one has troubled to measure them. Perhaps we should concern ourselves more seriously with giving our young women the *desire* to be fit. Should this objective become demanding, those within the profession of physical education must themselves attack the problems associated with its safe achievement.

REFERENCES

1. Bartlemetz, G. W., "Menstruation," *Physiol. Rev.*, 17 (January 1937) 28–72.
2. Bedale, E. M., "Two Contributions to the Experimental Study of the Menstrual Cycle. II. Its Relation to General Functional Activity," *Industrial Fatigue Research Board,* (London: His Majesty's Stationery Office, 1928).
3. Bilhuber, Gertrude, "The Effect of Functional Periodicity on the Motor Ability of Women in Sports," *Am. Phys. Ed. Rev.*, 32 (January 1927) 22–25.
4. Cannon, W. B., *Bodily Changes in Pain, Hunger, Fear, and Rage,* (New York: Appleton, 1929).
5. Corner, G. W., "The Nature of the Menstrual Cycle," *Medicine,* 12 (February 1933) 61–82.
6. Dill, D. B., "The Economy of Muscular Exercise," *Physiol. Rev.*, 16 (April 1936) 263–291.
7. Eggleson, Helen Elizabeth, "Periodic Changes in Blood Pressure, Muscular Coordination, and Mental Efficiency in Women," (Dissertation, Johns Hopkins University, 1924).
8. Grollman, Arthur, "Physiological Variations in the Cardiac Output, Pulse

Rate, Blood Pressure and Oxygen Consumption of a Normal Woman," *Am. J. Physiol.*, 96 (January 1931) 1–7.

9. Hellebrandt, Frances A., "Studies on Albuminuria Following Exercise. I. Its Incidence in Women and Its Relationship to the Negative Phase in Pulse Pressure," *Am. J. Physiol.*, 101 (July 1932) 357–364.
10. Hellebrandt, Frances A., Harry D. Baernstein, and Sara L. Hoopes, "Studies in the influence of Exercise on the Digestive Work of the Stomach. IV. Its Relation to the Physico-chemical Changes in the Blood," *Am. J. Physiol.*, 107 (February 1934) 370–377.
11. Hellebrandt, Frances A., Elizabeth Brogdon, and Sara L. Hoopes, "The Effect of Active Anoxemia on Hunger, Digestive Contractions, and the Secretion of Hydrochloric Acid in Man," *Am. J. Physiol.*, 112 (July 1935a) 451–460.
12. Hellebrandt, Frances A., Elizabeth Brogdon, and Sara L. Hoopes, "The Disappearance of Digestive Inhibition with the Repetition of Exercise," *Am. J. Physiol.*, 112 (July 1935b) 442–450.
13. Hellebrandt, Frances A., Elizabeth Brogdon, and L. E. A. Kelso, "Studies on Albuminuria Following Exercise. II. Its Relationship to the Speed of Doing Work," *Am. J. Physiol.*, 101 (July 1932) 365–375.
14. Hellebrandt, Frances A., and Lyndall L. Dimmitt, "Studies in the Influences of Exercise on the Digestive Work of the Stomach." III. Its Effect on the Relation between Secretory and Motor Functions," *Am. J. Physiol.*, 107 (February 1934) 364–369.
15. Hellebrandt, Frances A., and Sara L. Hoopes, "Studies in the Influence of Exercise on the Digestive Work of the Stomach. I. Its Effect on the Secretory Cycle," *Am. J. Physiol.*, 107 (February 1934) 348–354.
16. Hellebrandt, Frances A., and Meryl M. Miles, "The Effect of Muscular Work and Competition on Gastric Acidity," *Am. J. Physiol.*, 102 (October 1932) 258–266.
17. Hellebrandt, Frances A., and Rubye H. Tepper, "Studies in the Influence of Exercise on the Digestive Work of the Stomach. II. Its Effect on Emptying Time," *Am. J. Physiol.*, 107 (February 1934) 355–363.
18. Hellebrandt, Frances A., Rubye H. Tepper, Helen Grant, and Ruth Catherwood, "Nocturnal and Diurnal Variations in the Acidity of the Spontaneous Secretion of Gastric Juice," *Am. J. Digestive Diseases and Nut.*, 3 (September 1936) 477–481.
19. Hellebrandt, Frances A., Etta Walters, and Mary Louise Miller, "The Post-Exercise Suppression of Kidney Function in Man," *Am. J. Physiol.*, 116 (June 1936) 168–173.
20. Hollingsworth, Leta Stetter, "Functional Periodicity and Experimental Study of Mental and Motor Abilities of Women during Menstruation," (New York: Teachers College, Columbia University, 1914).
21. Jacobi, Mary Putnam, *The Question of Rest for Women during Menstruation*, (New York: C. P. Putnam's Sons, 1914).
22. Kelso, L. E. A., and Frances A. Hellebrandt, "The Recording Electrodynamic Brake Bicycle Ergometer," *J. Lab. and Clin. Med.*, 19 (July 1934) 1105.
23. Kirihara, Haken, "Functional Periodicity—Experimental and Statistical Studies on Rhythm in Working Capacity of Women," *Reports of the Institute for Science of Labor*, (Kurasiki, Japan, 1932).
24. Markee, J. E., "Rhythmic, Vascular Uterine Changes," *Am. J. Physiol.*, 100 (March 1932) 32–39.
25. Novak, Emil, "Recent Advances in the Physiology of Menstruation," *J. A. M. A.*, 94 (March 22, 1930) 833–839.
26. Rowntree, Leonard G., "The Effect on Mammals of the Administration of

Excessive Quantities of Water," *J. Pharm. and Exper. Ther.*, 29 (1926) 135–159.

27. Sanderson-Clow, Alice E., "The Effect of Physical Exercise on Menstruation," *J. of School of Hygiene and Physical Education*, (1923).
28. Scott, Gladys, and W. W. Tuttle, "The Periodic Fluctuation in Physical Activity during the Menstrual Cycle," RESEARCH QUARTERLY, 3 (March 1932) 137–144.
29. Sowton, S. C. M., and C. S. Meyers, "Two Contributions to the Experimental Study of the Menstrual Cycle: I. Its Influence on Mental and Muscular Efficiency," *Industrial Fatigue Research Board*, (London: His Majesty's Stationery Office, 1928).
30. Steinhaus, Arthur H., "Chronic Effects of Exercise," *Physiol. Review*, 13 (January 1933) 103–147.
31. Tuttle, W. W., "Changes of Irritability in Women during the Menstrual Cycle," *J. Lab. and Clin. Med.*, 11 (October 1925) 1–24.

Exercise and Heart Disease

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IT SEEMS that from every page of our health bulletins we are confronted with startling statistics on cardiac disease. We read that heart disease is the chief cause of death at every age period after 45 years, and that, under present conditions of mortality, one out of every five white persons born will eventually die of heart disease. When the Public Health Service took its census there were 2,500,000 of the 6,000,000 sick disabled by a chronic disease of the heart or circulatory system. It is estimated that about 1.5 per cent of children of school age have organic heart disease, which means there are approximately 435,000 cases.[1] * In spite of the alarming figures on heart disease it has been shown by Dr. Alfred E. Cohn of Rockefeller Hospital that there was no increase in the heart death rate among people under 50 years of age.

As one visits physical education classes in schools, the director speaks with enthusiasm of the special program of activities for the pupil handicapped with some orthopedic defect, but there is little mentioned about the program for the cardiac cripple. One may assume that the director is afraid of doing anything which he thinks may increase the heart damage, or that exercise may cause the child's death on the gymnasium floor. The result is that little is being done for the great majority of these pupils when so much can be done to aid the heart condition and to teach them how to live and enjoy a more fruitful life.

Cardiologists say that in individuals with cardiac pathology, the careful re-education of the remaining heart muscle is the main consideration in therapy. White thinks that the most important part of the treatment of the cardiac patient is the application of rest and recreation in some form.[2] Robinson states that all except the most severe cardiacs will benefit from postural exercises graded according to their ability to do them.[3] Williamson in his book says, "In place of the present practice of restrictive activities, I would therefore advocate that, as soon as we are satisfied that active infection has ceased, we should embark upon a course of intelligent exercise. Our object is to obtain as full development as possible of the myocardium."[4] There is no doubt that measured and regulated bodily activity has positive physical and psychic benefits. The purpose of this paper is to present some of the

* Refer to numbered Bibliography at end of article.

accepted facts on cardiac disease, and suggest a method by which physical educators may aid in their education and rehabilitation.

EXERCISE AND THE NORMAL HEART

Heart disease does not occur as a result of physical exertion. Sir Thomas Lewis was perhaps the first to emphasize the tremendous reserve power that is present in the normal heart. In his book *Soldier's Heart and the Effort Syndrome,* he makes a statement which all cardiologists who have investigated work in relation to the heart have tended to confirm. He says, "The burden imposed by physiological acts upon the heart, however heavy these burdens may be, never exhaust the heart's reserve. The reserve of other bodily structures will fall before the heart is pushed to its limits of endurance." [5] The evidence indicates that excessive exertion may be undertaken by an individual without injury to the heart if the muscle remains adequate and undiseased. It is the heart muscle which is the chief factor in determining the amount of work that can be performed. Boas states that the muscles will flag so that the person will collapse before the heart is called for its last ounce of effort. It is estimated by Wright that this may mean the normal heart must pump as much as six times the amount of blood per minute as it does during a period of rest.[6] Leading textbooks have for two generations been telling physical educators that the heart is vulnerable in childhood due to the natural disharmony between the development of the heart and the large blood vessels. These statements are unsupported by scientific evidence, says Karpovich, and he advises that "hygienic warnings based upon erroneous interpretations should be discarded." [7] Every physical educator who has observed the activities of normal children will agree with this statement. The evidence presented by Shirley indicates that the normal prepubescent's heart responds to exercise of graded intensity the same as adults.[8]

CAUSES OF HEART DISEASE

The greatest cause of cardiac disease in childhood is rheumatic fever. Rheumatic fever, says Wilson, owes its place as one of the most important diseases of childhood to the fact that the heart is probably always involved.[9] Published statistics for New York City reveal that rheumatic fever ranks highest as the cause of death for girls, and is second only to accidental deaths for boys. It has been estimated that 80 per cent of the adult heart disease in persons under the age of 40 is of rheumatic etiology, usually acquired in childhood, and that about 1 per cent of children of school age have rheumatic heart disease. It occurs at the average age of 12, and if the sufferer's heart is appreciably damaged, he has a small chance of living more than 15 years. The United States Health Service reports that rheumatic heart disease kills 25,000 to 30,000 persons every year and nearly all of these victims

are children or young people under 30 years of age. The sad thing about the matter is that no great progress has been made in the prevention of this disease. It is thought to be an infection but the cause is as yet unknown. Halsey thinks that the heart in the young is damaged by rheumatic infection in approximately 90 per cent of all instances and that possibly the heart never escapes without some damage.[10] Disregarding congenital defects, it is safe to say that in school children there is no primary disease of the heart. If a young person has an organic heart lesion it is due to some infectious disease, which in the majority of cases is rheumatic fever, although tonsilitis, diphtheria, scarlet fever, and other communicable diseases may produce the cardiac disability. The importance of a good past medical history to discover the acute communicable diseases is evident.

THE RESULTS OF CARDIAC DISEASE

The pathological changes which occur in the heart must be limited to those tissues which compose the organ: the pericardium, myocardium, endocardium, blood vessels, and nerves. The outermost layer is the pericardial sac, disease of which is pericarditis. Enclosed within the pericardium is the myocardium, or heart muscle, and inflammation of this is spoken of as myocarditis. Lining inner walls of the myocardium, and extending to form the valves of the heart, is the endocardium. Inflammation of this tissue is endocarditis, which process results, in the majority of cases, in scarring and deformity of the valves evidenced as an insufficiency or stenosis of the openings between the chambers of the heart. These irregularities produce murmurs which may occur at any of the four valves. Actually, what happens, says Tice, "the mitral regurgitant murmur constitutes 50 per cent of all single uncomplicated, organic murmurs heard." [11] In order to supply the heart with nourishment there must be an adequate blood supply to the tissues. The blood vessels are necessary to carry the blood to and from the tissues, and any disease of the arteries which prevents the heart from receiving nourishment will cause degeneration of the cells of the heart. In old age when degenerative changes occur in the vessels, coronary thrombosis and angina pectoris are common causes of death, but these diseases are rare in young people. We know that the stimulus to set in motion the heart beat is conducted through the heart by nerve tissue. When disease interferes with the conducting apparatus, changes in rhythm follow which may produce a heart block.

We may sum up our present knowledge as follows:

1. We know that as a result of infection affecting the heart, the peri-, myo-, or endocardium may be infected at the same time as the valves. The mitral valve is the one most often affected.

2. We must recognize that lesions in the valves will cause an increased strain on the muscles surrounding the chamber using the valve.

Hence hypertrophy is an expression of physiologic function more than of pathologic injury.

3. After middle life, even in those who have had no infectious conditions in youth, degenerative changes appear in the aorta and coronary vessels. A common result is chronic or sudden interference with the coronary blood supply.

4. The source of the impulse producing the beat is not known, but the nervous condition may be modified and produce changes in rhythm.

THE SIGNIFICANCE OF MITRAL LESIONS

The cardiac disease found in the majority of our school children is a mitral regurgitation, and Tice states that "the valve lesion is relatively of slight importance from a prognostic standpoint. Mitral regurgitation as such seldom kills. No matter what the character of the murmur may be, with the apex in a normal position or nearly so, there is no immediate danger." It is important to remember that the size of the heart is more important than the sound, and if the apex beat is within the nipple line you can be reasonably sure the heart is able to compensate for the valvular defect. The heart responds to work by hypertrophy and dilation, which generally displaces the apex beat to the left. When this occurs the individual should be carefully guarded against strenuous activities which place added work upon the heart.

CARDIOVASCULAR TESTS

A great need has been felt by cardiologists and physical educators alike for a heart function test to measure accurately the capacity of the heart. From early studies it was thought that changes in the pulse rate on rising from the lying to the standing position gave significant information; later, blood pressure readings were studied in combination with pulse rate, blood pressure, and exercise. The search for a satisfactory objective measurement continues at the present time. Larson investigated separate tests and found that with the exception of the McCurdy-Larson Organic Efficiency Test, none of them discriminated between individuals of three groups composed respectively of Olympic and varsity athletes, freshmen enrolled in physical education courses, and students confined in the infirmary for ill health.[12] Larson and McCurdy found that their own physical capacity test, which includes standing heart rate, diastolic blood pressure, pulse rate before and after a graded exercise, breath holding after exercise, standing pulse rate, and vital capacity would classify these subjects within their proper group.[13] Function tests, seeking to measure cardiac capacity in more refinement particularly as it is modified by disease, have unfortunately beeen uniformly disappointing. In dealing with cardiac cripples we are seeking to measure a selected group, the infirmary group, and we are forced to admit there is no simple satisfactory test at the present time which

will measure the capacity of individuals diagnosed as having organic lesions of the heart. The McCurdy-Larson Test seems to offer the best measure for judging the functional capacity of the heart, but it requires a trained technician to administer the test, and it is doubtful if physical educators would be allowed to give this test to cardiac cases. We must look for some other means of determining when the heart is calling on its reserve.

THE MEASURE OF CARDIAC RESERVE

How, then, can we judge the functional capacity of the heart and formulate a program of physical activities? Berthea thinks we are coming to read damage today not in terms of valve lesions and other physical changes but rather to base our conclusions more and more on the impairment of cardiac reserve.[14] Tice says, "If strenuous exercise can be indulged in without evidence of dyspnea, there is no reason for regarding the lesion with any immediate concern. The outlook in any case is in exact proportion to the reaction from exercise." Lewis classes breathlessness as the earliest and most valuable sign suggesting loss of reserve.

From the statements of cardiologists we are justified in saying as long as the individual with heart disease can exercise with his mouth closed the activity is not using the reserve power of the heart. Breathlessness in the cardiac case demands that exercise should stop.

THE CLASSIFICATION OF ORGANIC HEART DISEASE

It is evident that physicians realize the organic lesion has little relationship to the functional capacity of the heart. This fact is proven by the classification which has been adopted and distributed by the American Heart Association, Inc. They classify patients on the basis of the functional capacity of the heart.

The classification of organic heart cases is as follows:

Class I. Patients with organic heart disease, able to carry on ordinary physical activities without discomfort.

Class II. Patients with organic heart disease, unable to carry on ordinary physical activity without discomfort: A, activity slightly limited; B, activity greatly limited.

Class III. Patients with organic heart disease, and with symptoms or signs of heart failure when at rest, unable to carry on any physical activity without discomfort.

Class E; Possible heart disease; patients who show abnormal signs or symptoms referable to the heart but in whom diagnosis of heart disease is uncertain.

Class F; Potential heart disease; patients without circulatory disease whom it is advisable to follow up because of the presence of history of an etiologic factor that might cause disease.

THE PHYSICIAN AND EXERCISE FOR CARDIACS

Stroud states, "It is the sincere opinion of the author that physical therapy must take its place at the head of the various forms of treatment directed toward arresting the progress of cardiovascular disease." [13] Exercise is an important part of the physical therapy treatment.

Many years ago the Schoot brothers of Germany formulated a type of resistive exercises given patients with cardiac disease.[20] These exercises were to be given patients having a chronic cardiac infection who were forced to rest but needed some exercise to strengthen the heart muscle. The exercises were to be administered by the physician or any assistant, and the resistive motions were to be pleasurable to the patient. The exercises as outlined by the Schoot brothers are as follows:

1. The arms are to be raised slowly, outwards from the side until they are on a level with the shoulder. After a pause they should be slowly lowered.
2. The body should be inclined sideways as much as possible towards the right, and then to the left.
3. One leg should be extended as far as possible sideways from the body, the patient steadying himself by holding on to a chair. The leg is then dropped back. The same movements are repeated by the other leg.
4. The arms are raised in front of the body to a level with the shoulder, and then put down.
5. The hands are rested on the hips, the body is bent forward as far as possible and then raised to the upright position.
6. One leg is raised with the knee straight forward as far as possible, then brought back. This movement is repeated with the other leg.
7. With the hands on the hips, the body is twisted round as far as possible to the right, and then again to the left.
8. With the hands resting on a chair and the back stiff and straight, each leg is raised as far as possible backwards, first one and then the other.
9. The arms are extended and the fists supinated. The arms are then extended outward, next inward, at the height of the body.
10. Each knee is first raised as far as possible to the body, and then the leg extended.
11. This movement is the same as No. 9, but with the fists pronated.
12. Each leg is bent backward from the knee, and then straightened.
13. Each arm is bent and straightened from the elbow.
14. The arms are brought from the sides forward and upward, then downward and back as far as they will go, the elbows and the hands being straight.
15. The arms are put at a level with the shoulder and then bent from the elbows inward and again extended.
16. With the arms in front at the level of the shoulder, and the hands stretched, the arms are opened out sideways and then brought together.
17. The arms are bent from the elbow outward and extended.

Terrain Cure.—The terrain, or walking, cure was first introduced by Sir William Stokes. He was the first to call attention to the fact that rational gymnastics can produce hypertrophic changes and

strengthen the heart. His cure consisted of prescribing a definite dose of walking along paths of varying inclines, though it can be conducted on level ground. This principle of treatment was forgotten for about fifty years until Oretel reintroduced it. In general, the following rules were adopted in giving the treatment:

1. The patients must walk every day at two different periods over the ground prescribed, as far as they can without overfatigue. It is the patient who limits his walk as no one can tell when the patient is becoming fatigued. Between the walking exercises, which are separated by several hours, the patient is supposed to rest.
2. The patient must avoid all temporary overstrain of the heart. This can be controlled by limiting the time or speed, the distance to be traveled and by being sure he is not out of breath as a result of the walk.
3. The walk should be taken early in the day and all tiring movements avoided at the end of the day.

This method of treating cardiac patients has been adopted in several places in America. At Hot Springs, Arkansas, the County Medical Society had a course constructed for the Oretel system of graduated exercise. The Department of Interior surveyed the footpaths and determined the grades and elevations. Stone markers, which were numbered and colored, were placed along the paths. Small maps with routes colored to indicate the distances, grades, and altitudes were furnished the patients. Along the routes were benches and spring water for rest and refreshment. At Watkin's Glen, New York, a similar course was designed. At Saratoga Springs, New York, the golf course is used for cardiac patients and it has many of the elements of the "terrain cure." The various spas in America are recognizing the value of exercise and other forms of physical therapy in the treatment of cardiac diseases.

A PROGRAM FOR CARDIAC PATIENTS IN THE SCHOOLS

The evidence presented seems to be summarized in the statement by Boas who thinks, "A certain amount of well tolerated activity will make the circulatory apparatus a more efficient machine, will spare the heart a certain amount of work and promote a sense of well-being. It will also help to prevent obesity, which so often follows a too sedentary life and adds to the burden of the heart.[1]

The success of a program of physical activities for cardiacs depends upon the recognition of these principles and also upon the methods used in organizing the classes.

The following principles and procedures are suggested for consideration by those conducting cardiac classes:

1. No program of activities should ever be given a cardiac patient without written permission of a physician. This is an important safeguard for the physical educator as well as the institution for which he is working.

2. In writing for permission to give activities to a cardiac patient, the following things must be remembered:

a) The physician may know that exercises are indicated but he is responsible for the patient and will not delegate that responsibility unless he is sure the person conducting the exercises understands what is involved. Physicians know the training nurses receive and do not hesitate to delegate to them a prescribed treatment, but to many physicians a physical educator is just a big-muscle man. It is important to inform the physician of your knowledge of the factors involved in the treatment of cardiacs.

b) The suggested program of activities should be in terms of work performed by the patient and not in organized games involving personal contact. The letters often sent to physicians contain a list of activities such as volleyball, ping-pong, chicken fight, etc., and he is asked to check the activities in which the person may participate. The physician is not familiar with activities and games and should not be expected to translate them readily into terms of the work involved. One physician may authorize ping-pong on the basis of his own playing ability, which could hurt no cardiac, while another physician, being an expert player, may censure the physical director for suggesting so strenuous a game. Therefore a method of listing the work to be performed in the various cardiac classifications is offered.

Class I. These patients should be able to perform the regular class program without discomfort. If they are to be placed in a special class the following activities are suggested:

1. Handball, doubles, limit of five minutes or 10 points.

2. Basketball: (*a*) dribbling and shooting, (*b*) shooting and following shot, (*c*) game with one basket, 5-minute limit, (*d*) game with two baskets, 5-minute limit.

3. Baseball: (*a*) fielding grounders, (*b*) throwing to base, (*c*) bunting, (*d*) first-baseman's play, (*e*) playing indoor baseball game. (All these activities taking turns once in 30 seconds.)

4. Football: (*a*) snap back from center, (*b*) throwing and receiving forward passes. (Limit is once each minute.)

5. Soccer, game in limited area for 5 minutes.

6. Modified batball game.

7. Volleyball game, 10-minute limit.

8. Medicine ball catch and throw. Throw made in variety of ways.

9. Mat stunts: (*a*) forward roll, (*b*) backward roll, (*c*) head stand, (*d*) elbow balance.

10. Track events: (*a*) short run for form, (*b*) broad jump, (*c*) high jump, (*d*) two hurdles.

11. Golf driving.

Class II. Activities slightly limited:

1. Chinese handball, court 8 feet square. Ball must strike the floor before hitting the wall.

2. Basketball: (*a*) four shots, (*b*) shot and follow up, 15-foot limit. Not more than five times in one minute.

3. Baseball: (*a*) catch and throw, 25-foot limit, (*b*) throwing to base, (*c*) fielding grounder, (*d*) first-baseman's play, (*e*) bunting the ball without run to base.

4. Football: (*a*) snap back from center, (*b*) throwing and receiving forward pass, 25-foot limit.

5. Soccer: (*a*) kicking, (*b*) trapping, (*c*) heading ball.

6. Medicine ball catch and throw, 5-foot limit.

7. Volleyball, played over low net, court area limited to 16 feet square per player, 11-point game.

8. Golf driving.

Class III. Activity greatly limited:

1. Indoor golf putting.

2. Shuffleboard.

3. Ring toss up to 15 feet.

4. Bowling, 3 pins with indoor baseball, 20-foot limit.

5. Basketball shooting, not over 10 feet, no running, limited to 5 throws in a minute.

6. Football throw and catch, no running, 15-foot limit.

7. Soccer trap and kick for accuracy, no running, 15-foot limit.

The physician must be informed that no activity will be continued when the subject shows any signs of breathlessness, and no activity will require the pupil to be beyond the instructor's range of vision.

A PHYSICAL DIRECTOR'S LETTER TO A PHYSICIAN

It is difficult to formulate a letter which will follow all the outlined suggestions, since so much depends upon the local situation, institution, equipment, and personnel. The following letter is a suggested form which may be useful as a guide for those interested in starting a physical education program for people with cardiac disease:

Dear Doctor Brown:

The school which your patient, Henry Jones, is attending, has a special physical education class for children with cardiac lesions. The purpose of this class is to teach the child activities calculated to develop his cardiac reserve, as against those likely to prove harmful. The program followed has been selected as carefully as possible, in line with the principles approved by the American Heart Association.

The attached list of activities has been formulated for those cases in Class I and II in the classification of the American Heart Association. If you will check the activities in which you think Henry may participate, or suggest any others, we will be glad to follow your instructions. Our policy is to stop the activity at the first signs of dyspnea and no activity will require the pupil to be beyond the instructor's range of vision.

We are anxious that Henry's physical education may continue and we realize this program can best be accomplished by your help. We feel confident we can depend upon your cooperation.

Yours truly,

Director of Physical Education

CONCLUSIONS

1. It would seem that the need, the prescription of exercises, the measurement of results, and the safeguards against overwork are more clear cut in the treatment of cardiac patients than in most of the conditions we are attempting to treat in our corrective classes.

2. The physical education program which teaches the pupil the limitations which his heart places upon his activity program is an important educational procedure.

3. Physical education activities for pupils with cardiac disease should be included in the program of institutions having special classes for handicapped pupils.

BIBLIOGRAPHY

1. Boas, E. P., "How Restricted Is the Life of the Patient with Heart Disease?" *Hygeia* 16 (Sept., 1938) 801.
2. White, Paul D., "The Treatment of Heart Disease Other Than by Drugs," *Jr. A. M. A.* 98 (Aug. 6, 1927) 436.
3. Robinson, H. C., "The Physical Education of Cardiacs," *Jr. of Health and Phys. Ed.* 9 (May, 1935) 289.
4. Williamson, Bruce, *Vital Cardiology.* (Baltimore: William Wood and Co., 1934).
5. Lewis, Thomas, *The Soldier's Heart and the Effort Syndrome.* (New York: Paul D. Hoeber, Inc., 1918).
6. Wright, Samson, *Applied Physiology.* (New York and London: Oxford Medicine, Oxford University Press).
7. Karpovich, Peter V., "Textbook Fallacies Regarding the Development of the Child's Heart," RESEARCH QUARTERLY 8:3 (Oct., 1937) 33.
8. Shirley, M. J., "Responses of the Normal Prepubescent Heart to Exercises of Graded Intensity," RESEARCH QUARTERLY 6:3 (Oct., 1935) 104.
9. Wilson, May G., "Rheumatic Fever, Childhood Rheumatism," *Preventive Medicine* 2 (April, 1938) 7.
10. Halsey, R. H., "Etiology of Heart Disease," *Jr. Am. Med. Ass'n.* 98 (Feb. 20, 1932) 593.
11. Tice, Frederick, *Practice of Medicine.* (Hagerstown, Md.: W. F. Prior Co.) Vol. VI, Chapters III and VI.
12. Larson, L. A., "A Study of the Validity of Some Cardiovascular Tests." (Ph.D. Dissertation, New York University, July, 1938).
13. Stroud, W. D., *Physical Therapy in Cardiovascular Disease,* "Principles and Practice of Physical Therapy," Vol. I., Chap. XIII. (Hagerstown, Md.: W. F. Prior Co.).
14. Berthea, Oscar, "Cardiac Reserve in Relation to Continued Activity," *International Med. Digest* 26 (April, 1935) 240.
15. Deaderick, W. H., "Oretel System of Graduated Exercise," *N. Y. Med. Jr.* 103 (May, 1916) 925.

16. Barr, David P., "Exercise in Cardiac Disease," *Jr. A. M. A.* 91 (Nov. 3, 1928) 1536.
17. Bishop, L. F., "The Nine-Hole Cure for Heart Disease," *Med. Rec.* 140 (Sept. 5, 1934) 233.
18. Wiggers, C. J., "Physiologic Meaning of Common Clinical Signs and Symptoms in Cardiovascular Disease," *Jr. A. M. A.* 96 (Feb. 21, 1931) 603.
19. McCurdy, J. H., and L. A. Larson, "The Measurement of Organic Efficiency for the Prediction of Physical Condition," SUPP. TO RESEARCH QUARTERLY 6:2 (May, 1935).
20. Schoot, T., "On the Treatment of Chronic Diseases of the Heart," *Boston M. & S. Jr.* 156 (1907) 623.
21. Roesler, Hugo, "Exercise and the Heart," *Jr. of Health and Phys. Ed.* 7 (Oct., 1936) 471.
22. Bishop, L. F., Exercise in the Treatment of Chronic Cardiovascular Disease," *Arch. of Phys. Therapy* 19 (July, 1938) 415.
23. Schoot, T., *Balnee-Gymnastics Treatment, Exercises and Baths in the Treatment of Affections of the Heart.* (Philadelphia: P. Blakiston's Son & Co., 1914).
24. Brush, F., "Convalescent Treatment of Heart Disease by Exercise Applied Through Natural Work and Play Methods," *Med. Rec.* 99 (1921) 253.
25. Brush, F., "Recreational Therapy for Heart Disease," *Arch. Occup. Therapy* 1 (1922) 25.
26. Berlin, News Notes, "Heart Patients and Sports Activities," *Jr. A. M. A.* 102 (June 30, 1934) 2215.
27. Flannery, M. V., "Med. Gymnastics in the Treatment of Certain Abnormal Heart Conditions," *Physiotherapy Rev.* 9 (Feb., 1924) 1.
28. Brown, W. P., "The Control and Treatment of Cardiac Cases Occurring in School Children," *Jr. Health and Phys. Ed.* 5 (April, 1934) 7.
29. Karpovich, P. V., "Physical Exercise in Cardiac and Metabolic Diseases," *Jr. Health and Phys. Ed.* 6 (Oct., 1935) 9.

A Study in Variation in Response Time

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THE purpose of this study was to attempt to discover the extent of variation of reaction time as based upon the ability to move the hand in response to the stimulus of a bell at different hours throughout the day. A second factor of the study involved the use of a speed-accuracy test in an attempt to find if speed and accuracy in movement of the hand conform to the response to stimulus. Twenty-three male subjects were used, ranging in age from 17 to 33 years. These subjects were tested a total of 325 periods. Testing for individual subjects ranged from 87 periods over 11 days to four periods for a single day.

REVIEW OF LITERATURE

Very little literature was available which dealt with diurnal variation other than those which had to do with industrial fatigue.

In 1906 H. D. Marsh[1] * conducted an extensive study, "Diurnal Course of Efficiency." In this work the author used hourly ergograph records and dynamometer tests for bodily strength after various forms of activities, such as floor dips, floor squats, etc. He concludes: "As to strength (not meaning endurance) there is ample reason to believe that most commonly the first morning power is relatively low, but subject to a fairly rapid rise until about 11 A.M.; a slight backward tendency is then shown until 1 P.M., then a gradual ascent to the maximum between 3:30 and 5:30 P.M. and a gradual descent until bed time when a minimal descent is reached."

Whiting and English[2] conducted a study using college women as subjects in which tests for speed, accuracy, and steadiness were given in the morning before classes and after classes in the afternoon. Briefly the following tests were given: (1) attempting to draw a line a certain length while blindfolded; (2) dividing a line in thirds by ocular estimation; (3) problems in addition for 30 minutes; (4) holding a metallic stylus for steadiness; (5) 10 problems in multiplication without paper or pencil; (6) tapping two periods each for 30 seconds with each hand. These authors found no significant change in results taken in the afternoon as compared to those recorded in the morning.

Studies in industrial fatigue usually use spoiled work and output as a measure of efficiency. These studies in general coincide with the findings of Ryan and Florence.[3] In substance they found that the curve of spoiled work conformed inversely with the curve of output,

* Indices refer to Bibliography at end of article.

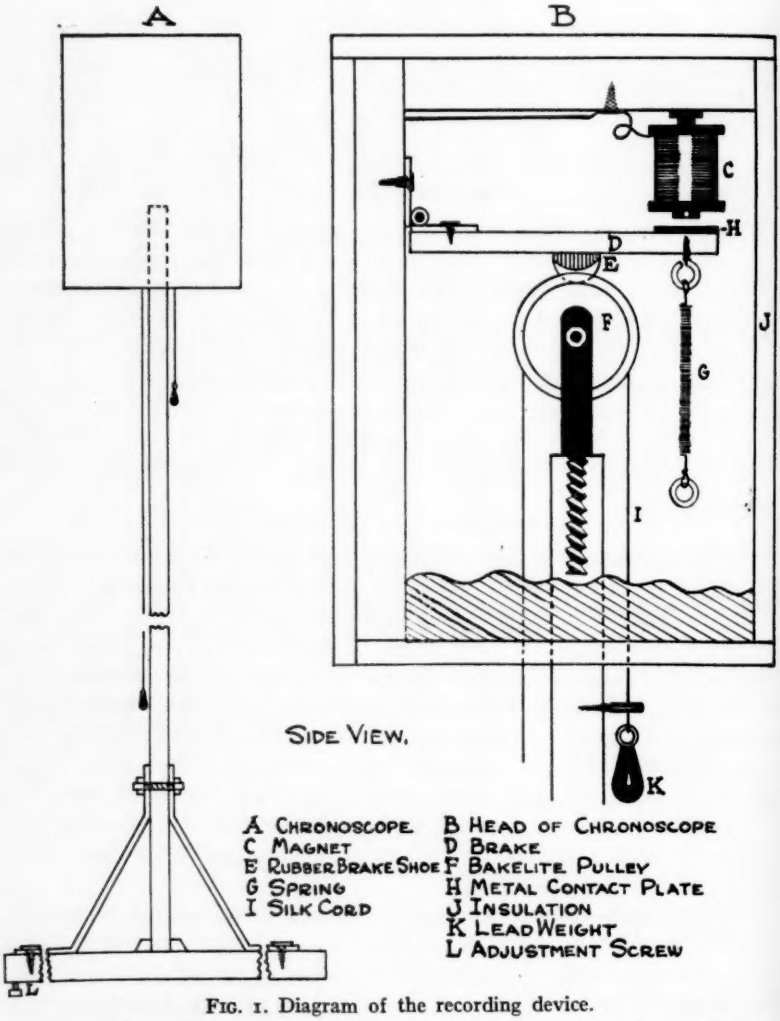


FIG. 1. Diagram of the recording device.

and that there was greater spoilage and less output in the earlier and later hours of the morning and afternoon.

Many studies show also the difference in output in industries with intermittent rest periods as compared to continuous effort over long periods. It has long been agreed that continuous activity causes increased metabolism and resulting waste products which are only removed by sleep or rest. It would be reasonable to assume that neuromuscular responses fluctuate with activity and rest in the daily routine. In this regard Griffith says: "All skills suffer temporary deterioration when they are exercised without rest."[4]

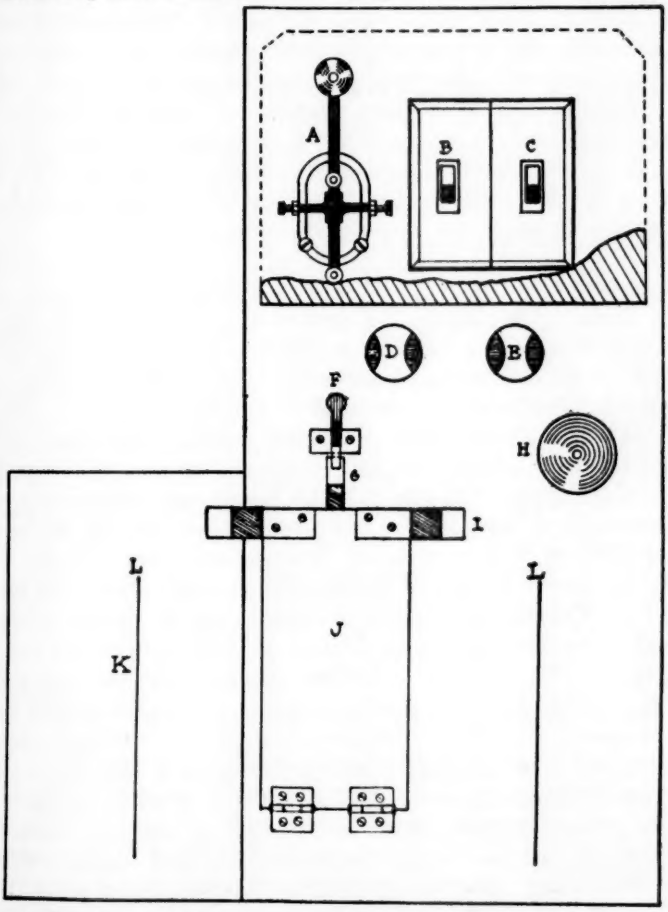
Woodrow [5] points out the effect of prolonged attention demanded

of the subject before presentation of the stimulus. The prolongation in reaction time, he feels, often results from absence of the stimulus while the subject concentrates upon the expected stimulus.

DESCRIPTION OF APPARATUS

The apparatus used in this study consisted of a stimulus-hand-response unit and a recording device.

Hand-Response-Stimulus Unit.—(Fig. 2.) The stimulus unit for all



A TELEGRAPH KEY
B LIGHT AND BELL SWITCH
C SWITCH for HAND or BODY SWITCH
D CHRONOSCOPE PLUG
E BODY SWITCH PLUG
F SPRING CATCH
G METAL CATCH BAR
H STIMULUS LIGHT
I ATTACHMENT for FINGER RESP.
J HAND RESPONSE SWITCH BOARD
K SHELF FOR LEFT HANDED SUBJECTS.
L GUIDE LINES

FIG. 2. Top view of the stimulus-hand-response unit

movements was so built that it also contained the device for response of the hand movement. This was accomplished by constructing an inverted box with the under surface open, with outside measurements 11 inches by 24 inches by 4 inches in height. Within the box were placed the stimulus bell, transformer for the bell, resistance lights for the chronoscope magnets, the switch for the hand response, and the necessary wiring for the stimulus key and electric plugs. This unit was so constructed that it operated as follows: the subject stands at one side of the table while the operator produces the stimulus by pressing a sensitive telegraph key (*A*, Fig. 2). This key, as well as the forearm of the operator, is hidden from the view of the subject by a wooden hood. Simultaneously with the pressing of the stimulus key, the bell rings and the weight of the chronoscope falls until the contact is broken by the subject striking the board switch surface (*J*, Fig. 2). This forces a plunger through a channel in the surface of the box and breaks the contact of a spring switch on the under side.

Recording Device.—A modified Hipp chronoscope was used as the timing device for this study, the method of measure being based upon the falling of a weight which is retarded in its fall by a lighter one. The head of the chronoscope is housed in a box at the top of an upright 68 inches in height and 6 inches in width (*A*, Fig. 1). The upright also serves as the calibrated scale. A single lightly constructed bakelite pulley, with cone bearings set in a U-shaped bracket, is screwed into the top of the upright (*F*, Fig. 1). This pulley, one and one-half inches in diameter, and containing a V-shaped groove, extends far enough beyond the face of the upright to allow the silk cord (*I*, Fig. 1) supporting the two weights and the weights to move freely. An electromagnet (*C*, Fig. 1) with contact plates extending downward is securely fastened to the inner surface of the top of the housing. When the stimulus key (*A*, Fig. 2) is pressed, these magnets raise the pulley brake (*D*, Fig. 1) thus releasing the weights. The larger of the weights weighs 26.8284 grams, and the smaller 18.1430 grams. In construction of the apparatus the brake proved to be a problem. A satisfactory arrangement was finally designed by using a piece of wood one-quarter inch thick by two inches wide by four inches in length as the main part of the brake (*D*, Fig. 1). This was fastened to the back of the housing by means of a hinge. On the top of the brake a metal strip serves in operation as a contact plate for the magnets (*H*, Fig. 1). To the lower surface of the brake and directly over the uppermost point of the pulley, a V-shaped rubber "button" was fastened (*E*, Fig. 1). This rubber was so cut that the smallest part presses the weight cord securely against the pulley. Tension is applied to the brake by means of a spring (*G*, Fig. 1) which extends from a screw eye on the forward part of the undersurface of the brake to a wire bracket four inches

below. The tension on the spring is so adjusted that when the magnets release the brake the weights are stopped instantly. This instrument was calibrated to units of 1/100 of a second according to the method suggested by Stroll and Burpee.[6]

TESTS

Hand Response.—This test consisted in the movement of the hand of the subject's choice in response to the stimulus of a bell using the stimulus-hand-response unit previously described. In another study the coefficient of correlation of this test was found to be .9637.[7]

Speed-Accuracy Test.—Aside from the movement of the hand, an additional test was given to all the subjects. This test was designed to attempt to determine the speed and accuracy of the subjects by comput-

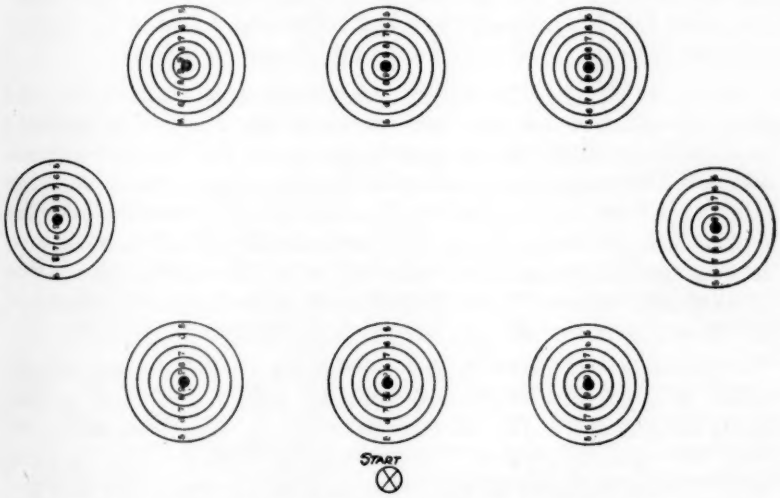


FIG. 3. Reproduction of test sheet for speed-accuracy test

ing the total score made by the ability to punch holes in paper targets with a sharp stylus in a period of five seconds. Eight targets were mimeographed on sheets of 8½ by 14 inch paper. Each target was one and three-quarter inches in diameter and formed by six concentric circles. Three targets were mimeographed at either side of the length of the paper at equal intervals. The remaining two were placed one at either end at the center of the width of the page. (Fig. 3.) These targets were graded from the blackened "bull's-eye" in the center which scored 10 points. Proceeding outward, each space between the concentric circles was scored 9, 8, 7, 6, 5 points respectively. For punches that missed the entire target, two points were scored. For a "hit" that in any way broke the line of one of the circles of a target the score was

recorded for the next highest space. The total score of all targets was considered the speed-accuracy score. In another study the coefficient of correlation of this test was found to be .9556.[7]

PROCEDURE

Subjects in this study had been previously used in another experiment in which the same equipment was used. This fact made it unnecessary to have each subject undergo a preliminary period of training in the techniques involved. After five practice trials each on the movement of the hand in response to the stimulus of the bell and the speed-accuracy test, the subject was given ten trials in the hand response and one trial in speed-accuracy. During each period of testing the average of the ten trials in hand response and the total score of speed-accuracy were used. The same procedure was followed for each period of testing. Subjects were called into the testing room individually and were seated at a table for the speed-accuracy test. This was followed by the test for hand response. The tests were administered as follows:

Hand Response.—The subject was requested to stand facing, and at the opposite side of a table from, the tester. He was further requested to place the hand of his choice, palm down, on the stimulus response unit with the thumb outside a guide line (*L*, Fig. 2) three and one-half inches from the hand switch (*J*, Fig. 2). He was then informed that striking the hand switch in response to the stimulus would stop the ringing of the bell and the falling of the weight on the chronoscope. Detailed instruction was not necessary, of course, for each period of testing.

Speed-Accuracy Test.—A sheet containing the targets was thumb-tacked to a soft pine board with the long axis of the paper at right angles to the subject. He was then given the stylus and was instructed upon the command "get set" to place its point at the starting mark below the center target at the lower edge of the paper. He was also informed that upon the signal "go" he was to proceed as rapidly as possible in a clockwise direction piercing each target in consecutive order as near the center as possible until the tester called "stop." He was likewise informed that speed played an important part in the test since he would be given but five seconds. Each subject was then given five practice trials before his first test and one trial before each testing period thereafter. A stop watch was used to determine the time in all instances.

The first period of testing was at 8:20 A.M., and in some instances was conducted at 20 minutes after the hour throughout the day through 5:20 P.M. In other instances the subject was tested as many times as convenient to him. Some cases were used only at 8:20 A.M., 12:20 P.M., 1:20 P.M. and 4:20 P.M. In all cases no attempt was made to supply artificial situations. The subjects were instructed to follow their normal daily routines.

The subjects were tested as follows:

A—11 days for 87 periods	D— 3 days for 22 periods
B—11 days for 78 periods	E— 2 days for 16 periods
C— 5 days for 39 periods	F— 2 days for 12 periods

The remaining fourteen subjects were tested one day for a total of four periods each; three subjects one day each for five periods each.

FINDINGS: HOURLY VARIATION

Hand Response—All Subjects.—Taking all cases for the total of 325 periods of testing it will be found that the mean scores for reaction time (recorded in fractions of seconds) each hour starting at 8:20 A.M. are as follows:

Time	No. of Testing Periods	Scores	Time	No. of Testing Periods	Scores
8:20	49	.256	1:20	46	.249
9:20	25	.238	2:20	27	.237
10:20	29	.241	3:20	24	.239
11:20	27	.242	4:20	43	.249
12:20	42	.257	5:20	13	.245

Most of the readings were taken at 8:20, 12:20, 1:20, and 4:20. The smallest number were taken at the 5:20 period, when the results of but 13 testing periods are recorded. For that reason the figures will not be considered as significant as for other periods.

The mean score for all cases at 8:20 was found to be .256 sec. There was a decided improvement in the hand response at 9:20 with a mean reading of .238 sec. On the basis of speed the 9:20 mean reading represents the best score of the morning periods. The mean scores for the 10:20 and 11:20 periods show a slight slowing as compared to the 9:20 mean. The slowest mean score of the day is reached at 12:20, the before lunch period, with a mean score of .257 sec. The 1:20 mean score shows an improvement over 12:20. At 2:20 the mean score was found to be the fastest of the day, slightly better than the 9:20 period and an improvement of .020 sec. over the 12:20 mean score. The 3:20 and 4:20 mean scores show a slowing of response, and 5:20 readings, although comparatively few were taken, show a slight improvement in response time over the 4:20 period.

Speed-Accuracy—All Subjects.—The speed-accuracy tests were taken at periods coinciding with those for reaction time. The following shows the mean scores for each period and the number of periods in which the test was given:

Time	No. of Testing Periods	Scores	Time	No. of Testing Periods	Scores
8:20	49	172	1:20	46	172
9:20	25	164	2:20	27	172
10:20	29	169	3:20	24	168
11:20	27	166	4:20	43	174
12:20	42	170	5:20	13	164

The tabulation of these results for all cases shows the highest mean score of 174 points having been recorded at 4:20 P.M. and the second highest mean score, 172, at 8:20, 1:20, and 2:20. The low mean score of the day was found to be 164 at 9:20 A.M. The same score was shown with a lesser number of cases at 5:20 P.M. (See Fig. 4.)

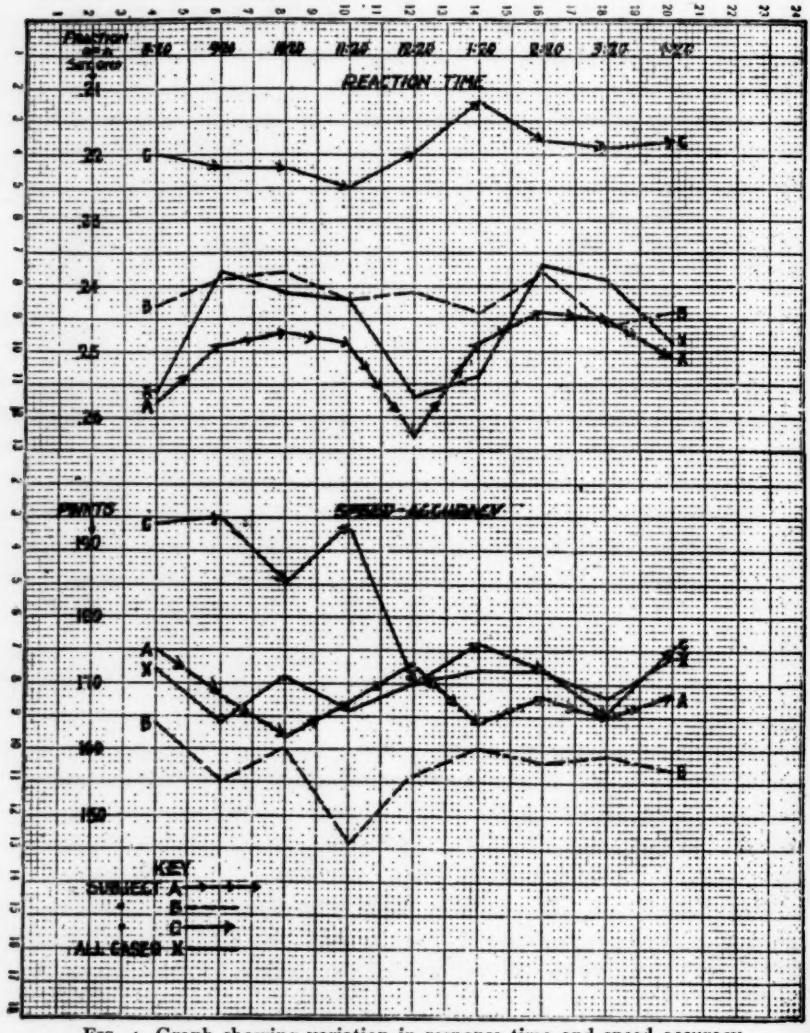


FIG. 4. Graph showing variation in response time and speed accuracy

Comparison Hand Response and Speed-Accuracy Test.—A comparison of the mean scores of the hand response and speed-accuracy test for the entire group of subjects can well be made by using the following chart:

Hour	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20
Mean Scores Response Time	.256	.238	.241	.242	.257	.249	.237	.239	.249	.245
Mean Scores Speed-Accuracy	172	164	169	166	170	172	172	168	174	164

The above would indicate that response time scores do not coincide with speed-accuracy test scores. The second high mean speed-accuracy score of 172 was obtained at 8:20, 1:20, and 2:20. The 8:20 period showed one of the slowest response time means while the 2:20 period showed the fastest. While the fastest morning mean in response time was found to be at 9:20, the speed-accuracy mean for this period was one of the lowest. The graph shown in Figure 4 adequately shows the comparison of the results of the two tests.

Results when Tested More than One Day.—Subject *A* was tested for a total of 87 periods through 11 days. The testing was started on Monday and continued through Saturday. It was started again on the following Monday and continued through Friday. The tabulation of the results for hand response shows a mean score of .258 sec. at 8:20, .249 at 9:20, and the fastest score of the morning .247 at 10:20. The 11:20 period shows a slight dropping back as compared to 10:20, with a mean score of .249 sec., identical with the 9:20 mean. The low daily mean score, .263 sec., was reported at the 12:20 period. Disregarding the means for the 5:20 periods, the mean scores for the afternoon periods show the 1:20 period .249 sec. and the daily fastest time of .244 sec. at 2:20. The mean score at 3:30 was .245, only slightly slower than the previous period, while the 4:20 period showed a mean of .251.

The speed-accuracy means of this subject show that the highest mean score, 175 points, was obtained at 8:20, and the second high score, 173, at 12:20. The lowest mean score, 162, was made at 10:20. From the accompanying result tabulations and the graphs in Figure 4 it is possible to find the comparison of the reaction time mean scores and the speed-accuracy mean scores for this subject as well as a comparison with the trend of the entire group.

SUBJECT A

RESPONSE TIME

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	.293			.281	.295	.270			.265		.281
T	.255		.271	.242	.270	.248	.244	.254	.265		.256
W	.265	.266	.257	.278	.265	.259	.248	.249	.265		.261
T	.263	.260	.246	.247	.257	.247	.235	.246	.252	.246	.250
F	.248	.237	.236	.228							.237
S	.249	.233	.245	.242	.248	.236	.241	.232	.238	.232	.240
M	.244	.242	.248	.244	.270	.245	.245				.248
T	.263	.249	.230	.243	.256	.251	.252	.242	.239	.250	.248
W	.257	.242	.242	.243	.258	.245	.244	.257	.248		.248
T	.256	.246	.269	.242		.258	.254				.254
F	.250	.245	.234	.250	.249	.233	.235	.236	.229		.240
Avg.	.258	.249	.247	.249	.263	.249	.244	.245	.251	.243	

SPEED-ACCURACY (Subject A)

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	172			199	165	169			172		175
T	184		163	189	197	185	177	157	169		178
W	190	175	181	174	163	171	177	145	169		172
T	176	161	163	144	165	161	163	163	166	148	161
F	160	138	141	144							145
S	158	161	158	173	163	167	161	166	158	164	163
M	182	148	154	161	167	153	135				157
T	175	150	159	162	173	174	182	172	163	183	169
W	159	158	176	156	174	159	153	160	177		164
T	154	171	156	169		152	185				165
F	165	153	173	170	191	153	180	191	164		171
Avg.	175	168	162	167	173	164	168	165	167	165	

Subject *B* was tested for a total of 78 periods upon 11 days, starting on Monday and running through Saturday, and then on Monday of the next week through Friday. The tabulated results for the hand response show a mean score of .243 sec. at 8:20, and an improved speed at 9:20 with a mean score of .239 sec. The fastest score of the morning was made at 10:20 with a mean of .238 sec. The 11:20 and 12:20 mean scores were found to be .242 and .241 sec. respectively. The 1:20 mean score of .244 sec. is identical with the 4:20 mean, while the 2:20 mean equals the fastest score of the morning—.238 sec. The slowest score of the day was recorded at 3:20 with a mean of .246 sec.

Reviewing the result chart for this subject it will be found that the high speed-accuracy score was achieved at the 8:20 period with 164 points. The next highest score, 160 points, was made at 10:20 and 1:20. The low mean score of the day, 146 points, was made at 11:20. (See Fig. 4.)

SUBJECT B

RESPONSE TIME

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	.281		.276		.263	.252		.274	.263		.268
T		.276	.260	.262	.256	.251		.252	.265	.246	.259
W	.246		.249	.238	.234						.242
T	.255	.250	.242	.240		.259	.232	.233	.234	.256	.245
F	.239	.242	.231		.256	.238	.248	.243	.255		.244
S	.236	.239									.237
M	.241	.226	.224	.234	.230	.222	.237	.241	.234	.234	.232
T	.236	.243	.220	.263	.219	.252	.238	.264	.241		.242
W	.244	.215	.221	.235		.235	.237	.237	.237	.234	.233
T	.230	.234	.233	.229	.234	.238	.233	.234	.226		.232
F	231	.222	.233	.237							.231
Avg.	.243	.239	.238	.242	.241	.244	.238	.246	.244	.242	

SPEED-ACCURACY

M	187		188		180	191		191	174		185
T		167	171	163	164	168		165	171	176	168
W	184		166	180		168					175
T	197	168	156	140		136	181	151	153	158	160
F	153	182	146		151	184	156	160	152		160

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
S	157	144									151
M	149	157	158	150	140	155	162	169	158	161	156
T	169	157	158	137	157	144	160	140	147		152
W	134	149	143	107		137	133	135	143	141	136
T	154	125	136	151	146	160	157	157	160		150
F	155	145	179	141							155
Avg.	164	155	160	146	156	160	158	159	157	159	

Subject *C* was tested for a total of 39 periods for five days, starting on Monday and continuing through Thursday, and on the following Monday. The result chart for this subject shows the 8:20 period with a mean score of .220 sec. This mean was also recorded at 12:20. Scores of .222 sec. were made at 9:20 and 10:20 and the slowest mean score of the day at 11:20 (.225 sec.). All afternoon mean scores exceed the morning means in speed. The fastest mean time for the day appeared at 1:20 with .212 sec. followed by .218 sec. at 2:20, .219 sec. at 3:20, and .218 sec. at 4:20.

The speed-accuracy mean scores show the highest total points at 9:20, 195 points, and the second highest at 8:20 and 11:20 with 194 points. The lowest mean score, 165 points, was made at 3:20 and the second lowest, 170 points, at 12:20. (See graphs in Figure 4.)

SUBJECT C

RESPONSE TIME

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	.219	.213	.204	.215		.207	.213	.204	.213	.207	.211
T	.221	.222	.228	.223	.220	.220	.218	.229	.218		.222
W	.231	.231	.223	.228	.220	.218	.215	.224	.223		.224
T		.234	.226	.216			.226				.226
M	.210	.217	.228	.244		.205	.220	.220	.219		.220
Avg.	.220	.222	.222	.225	.220	.212	.218	.219	.218	.207	

SPEED-ACCURACY

M	222	195	193	198		193	195	178	184	177	193
T	178	201	192	200	196	158	145	155	147		175
W	176	174	181	206	144	168	150	138	162		167
T		199	200	161			174				184
M	200	203	158	200		185	198	188	207		192
Avg.	194	195	185	194	170	176	172	165	175	177	

Subject *D* was tested for a total of 22 periods on three days, Monday, Wednesday, and Friday of the same week. He was tested but four periods the first day and nine periods each for the remaining two. The 8:20 period shows a mean score for hand response of .268 sec. This is next to the slowest mean. The slowest mean (.270 sec.) was recorded at 12:20. The second fastest mean score, .251 sec., was made at 4:30, and the fastest was at 2:20 with a score of .244 sec.

In speed-accuracy the highest mean score, 199, was at 3:20 and the second highest, 198, at 2:20. The third highest mean score was 185 coming at 8:20. The lowest mean score, 171, was made at 1:20. (See Fig. 4.)

SUBJECT D

RESPONSE TIME

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	.299				.300	.274			.257		.283
W	.268		.260	.265	.260	.253	.247	.259	.244	.246	.256
F	.238	.252	.262	.253	.250	.249	.241	.252	.251		.250
Avg.	.268	.252	.261	.259	.270	.258	.244	.255	.251	.246	
					SPEED-ACCURACY						
M	183				196	165			183		182
W	192		168	168	174	178	210	227	193	155	185
F	181	181	180	168	153	170	186	162	187		174
Avg.	185	181	174	168	174	171	198	199	188	155	

Subjects *E* and *F* were taken upon two different days. The result charts for each are shown below. Although it was not the intention in this study to make comparisons between individual subjects, it is interesting that the fastest mean single period score (.195 sec.) for any subject in hand response was made by subject *E* during the 1:30 period of the second day of testing. The fastest mean score for a single day, .207 sec., was accomplished by this subject on the same day. (See Fig. 4.)

SUBJECT E

RESPONSE TIME

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	.230				.218	.218	.215	.211	.221	.228	.220
F	.213	.218	.217	.212	.204	.195	.202	.203	.200		.207
Avg.	.222	.218	.217	.212	.211	.207	.209	.207	.211	.228	
					SPEED-ACCURACY						
M	189				185	191	190	195	229	195	197
F	159	143	181	167	164	170	179	163	193		169
Avg.	174	143	181	167	175	181	185	179	211	195	

SUBJECT F

RESPONSE TIME

Day	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
M	.287		.279		.283	.260	.254	.240	.256		.266
Th.	.255				.244	.251	.242		.246		.248
Avg.	.271		.279		.263	.255	.248	.240	.251		
					SPEED-ACCURACY						
M	208		215		209	183	220	196	188		203
Th.	203				215	199	199		211		205
Avg.	205		215		212	191	209	196	199		

The mean scores of the hand response for subjects *G* to *W*, inclusive, for the 8:20, 12:20, 1:20, and 4:20 periods show the slowest mean—.269 sec. at 8:20. The 12:20 period shows a slight improvement over 8:20 as does the 1:20 period over the 12:20 period. The fastest mean time of the day is .262 sec. at 4:20, almost identical with the 1:20 score.

The highest speed-accuracy mean score, 178, was made at 1:20 and the next fastest, 169, at 4:20. The 8:20 mean score was 165 and the low mean, 162, at 12:20. (See Fig. 4.) The result chart for these subjects follows:

SUBJECTS G TO W

RESPONSE TIME

Subject	8:20	9:20	10:20	11:20	12:20	1:20	2:20	3:20	4:20	5:20	Average
G	.254				.247	.250			.248		.250
H	.269				.290	.282			.267		.277
I	.226				.245	.237			.238		.237
J	.257				.262	.253			.258		.258
K	.239				.222	.249			.242		.238
L	.290				.284	.253			.253		.270
M	.293				.288	.278			.268		.282
N	.253				.246	.261			.256		.254
O	.257				.258	.265			.256		.259
P	.295				.280	.279			.278		.283
Q	.309				.316	.272			.314	.267	.296
R	.278				.273	.271	.276				.275
S	.271				.268	.265			.268	.277	.270
T	.305				.281	.285			.292	.265	.286
U	.248				.248	.239			.249		.246
V	.270				.254	.273			.243		.260
W	.216				.257	.263			.267		.251
Avg.	.269				.266	.263			.262	.270	

SPEED-ACCURACY

G	160				168	200			182		178
H	174				183	223			190		193
I	140				152	189			180		165
J	181				181	217			211		198
K	136				187	163			183		167
L	154				144	177			158		158
M	165				162	169			135		158
N	157				136	157			135		146
O	181				209	189			177		189
P	200				197	170			184		188
Q	138				160	169			145	175	157
R	146				137	156	169				152
S	177				172	160			175	154	168
T	158				150	143			145	142	148
U	190				182	180			186		185
V	162				174	175			175		172
W	193				160	223			215		198
Avg.	165				162	178			169	157	

FINDINGS: DAILY VARIATION

Subjects A, B, C.—The results of subject *A* show that there were seven days in which a nearly equal number of testing periods were used in both the mornings and afternoons. These days were Tuesday, Wednesday, Thursday, and Saturday of the first week, and Tuesday, Wednesday, and Friday of the second week. These means show considerable variation with the slowest mean response time score (.261) sec.) coming on Wednesday of the first week. The second slowest mean was on the day before—.256 sec. The fastest mean score, .240 sec., came on Saturday of the first week and Friday of the second week.

The speed-accuracy scores show the highest mean score, 178, coming on Tuesday of the first week and the second highest on the following day. The lowest mean score was made on Thursday of the first week. The mean scores by the days are as follows:

	Tues.	Wed.	Thur.	Sat.	Tues.	Wed.	Fri.
Mean Hand Response.....	.256	.261	.250	.240	.248	.248	.240
Mean Speed-Accuracy	178	172	161	162	169	164	171

The days during which subject *B* was tested an equal number of periods in the mornings and afternoons were Monday, Tuesday, Thursday, and Friday of the first week and Monday, Tuesday, Wednesday, and Friday of the second week. The slowest mean hand response score for all days was .269 sec. for Friday of the first week. The second slow score, .268 sec., was made on the first Monday. The fastest mean score, .232 sec., was achieved upon three different days, Monday, Wednesday, and Friday of the second week. The highest speed-accuracy score was made on Monday of the first week with a total of 185. This was made while the second slowest hand response score was recorded. The lowest speed-accuracy scores, 136, 150, and 152, were made on Tuesday, Wednesday, and Friday of the second week. It will be noted that two of these low scores were made on days when the fastest hand response scores were accomplished. The daily mean scores for subject *B* follow:

	Mon.	Tue.	Thurs.	Fri.	Mon.	Tue.	Wed.	Fri.
Mean Hand Response..	.268	.259	.245	.269	.232	.242	.232	.232
Mean Speed-Accuracy..	185	168	160	156	160	152	136	150

The scores for subject *C* involved five days of testing. Four of the daily means will be listed here since on one day there were but four testing periods. The four days involving several testing periods were Monday, Tuesday, and Wednesday of one week, and Monday of the following week. The fastest mean score for hand response, .211 sec., was made on the first day of testing. The other three days remained comparatively uniform, with the second highest score being made on the final testing day. The highest speed-accuracy score, 193, was also made on the first day and the second highest speed-accuracy score, 192, was made on the second Monday along with the second highest hand response mean score. The daily mean scores for subject *C* follow:

	Mon.	Tues.	Wed.	Mon.
Mean Hand Response	.211	.222	.224	.220
Mean Speed-Accuracy	193	175	164	192

DISCUSSION

In a study of the results, one will notice that there is a decided fluctuation in mean scores compared hour for hour in both the hand response and speed-accuracy. The speed-accuracy means do not coincide with the hand response. There is a tendency for subjects to reach a high point in hand response in the morning and a slightly higher mark in the afternoon. Marsh[1] found points of higher efficiency in the morning and afternoon in his study of diurnal variation based upon tests involving muscular work. It has been suggested that these "high points" may come at the peak of the digestive process.

While no statistics were kept regarding the feeling of well-being or fatigue of the subjects, it is interesting that the highest speed-accuracy and most rapid hand response scores for subject *C* were made when he complained of feeling very tired. This subject had but three hours of sleep the night before the first day of testing.

It will also be noted that just as individuals differ in reaction time and speed-accuracy, they do not follow a uniform trend in hourly and daily variation.

As has been previously mentioned, Whiting and English[2] conducted a study involving several tests of accuracy and speed. These writers tested the subjects in the morning before classes and in the afternoon after classes, and concluded that there was little change in the afternoon as compared to the morning. It will be recalled that in this study, results of the seventeen subjects tested at 8:20, 12:20, 1:20, and 4:20 indicated very little change in mean scores from period to period. The results of individuals tested throughout the day and the trend of the entire group is in the direction of certain points of improved efficiency at intervening periods. The point of efficiency at 4:20 may coincide closely with the 8:20 period, but little of the story has actually been told. In this respect, it would be interesting to determine what occurs in these measures hourly throughout the day and until bed time at night.

While it was decided in this study to use the average score of ten trials in hand response during each testing period, there is considerable question whether this is not too many trials. Woodrow[5] suggested that prolongation of the period before stimulus while the subject is at attention causes an increase in reaction time. Since it is necessary to vary the length of interval between the preliminary warning and the stimulus, extreme attention is necessary on the part of the subject. After testing periods the subjects frequently complained of this sense of tenseness during the last several trials. It would seem that either five or seven would be adequate.

The fact that the results for all subjects frequently show a slow mean response time, and at the same period a high speed-accuracy score, may be due to a slightly slower but more deliberate performance in the latter test.

CONCLUSIONS

1. The results of the test of all subjects in hand response show two periods throughout the day, one in the morning and one in the afternoon, in which high mean scores are reached. The maximum speed is reached in the afternoon period.

2. Considering all subjects, the slowest periods in hand response were found to be early and late in the morning, the slowest period of the day being at 12:20.

3. The results of hand response of individual subjects do not conform in all respects to the results for the entire group, but do show a tendency toward a slow response early and later in the morning with a high period of efficiency in the morning and a maximum mean score in an afternoon period.

4. The results of the speed-accuracy test do not follow a uniform trend. The scores for the entire group show a relatively high score the first period in the morning and the low mean of the day the second period (at 9:20).

5. The results for individual subjects in the speed-accuracy test show a tendency toward a high mean score early in the morning and a fluctuation throughout the day.

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BIBLIOGRAPHY

1. Marsh, H. D., "Diurnal Course of Efficiency," *Archives of Philosophy and Psychological Method,* 7 (1906).
2. Whiting, Helen F., and H. B. English, "Fatigue Tests and Incentives," *Journal Experimental Psychology,* 8 (1925).
3. Meyers, C. S., Quoting Ryan and Florense, "Industrial Fatigue," *Lancet,* 1: 905-08 (May 2, 1925).
4. Griffith, C. R., *Psychology of Athletics* (New York: Charles Scribner's Sons, 1928).
5. Woodrow, Herbert, "The Measurement of Attention by Reaction to Change in Intensity," *Psychological Monographs,* 17:1-65 (1914).
6. Burpee, Royal H., and Wellington Stroll, "Measuring Reaction Time of Athletes," RESEARCH QUARTERLY, 7:1 (March 1936).
7. Elbel, Edwin R., "A Study in Response Time before and after Strenuous Exercise," Doctor's Dissertation, University of Iowa.

Grade Placement of Folk Dances

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PURPOSE OF INVESTIGATION

THE purpose of this investigation is to determine the grade placement of folk dances. That such an investigation was necessary is shown by such discrepancies as finding the same dances in grades III and VII or VIII, or sometimes in a higher grade in some courses of study, and finding a spread of choices in the tables of this study ranging sometimes over seven and eight grades.

Dances are often repeated for recreational purposes in grades above those in which they were first taught. While this is most desirable, the facts revealed in this study do not suggest such procedure but rather that there is a lack of uniformity in grade placement.

PROCEDURE

To secure information on grade-placement, two check lists of folk dances (and a few popular non-folk dances), one for grades III-VII, and one for grades VI-X, were prepared. In order to permit some leeway upward and downward, grades VI and VII were included in both check lists. Grade III was thought to be about the starting point for the teaching of folk dances and grade X the last in which new ones might be taught. No doubt, grades below and above these are also suitable and are mentioned as such for some folk dances as the tables show.

The dances of the check list were secured from several folk dance books and city and state syllabi in which they were graded, and from the writer's experience. One hundred fifty-two dances were listed to be checked. To these, forty-four, some of which were not folk dances, were added by teachers checking the lists, making a total of one hundred ninety-six dances on which opinions were expressed.

A letter asking for cooperation in the plan was sent to the directors of physical education of fifteen cities.* It was granted by all. Thereupon, to simplify the task for the directors, twenty letters and check lists addressed to teachers were sent to each director with the request to distribute, collect, and return them. Two teachers from each grade

* The following supervisors and directors of physical education have cooperated in determining the grade placement of dances: J. A. Johnson, Des Moines, Iowa; E. Tucker, Minneapolis, Minnesota; A. O. Anderson, St. Louis, Missouri; E. Hoppe, Milwaukee, Wisconsin; August Pritzlaff, Chicago, Illinois; Grace Stafford, Gary, Indiana; L. S. Moorehead, Columbus, Ohio; W. K. Streit, Cincinnati, Ohio; Floyd Rowe, Cleveland, Ohio; Dr. H. Burns, Pittsburgh, Pennsylvania; G. W. Mueller, Philadelphia, Pennsylvania; V. Blanchard, Detroit, Michigan; Carl H. Burkhardt, Buffalo, New York; Paul Krimmel, Syracuse, New York; and teachers of Indianapolis Public Schools.

in each city were asked to check the dances. In the junior and senior high schools the teachers of physical education did the checking. In order to get a teacher's independent opinion based on her experience in teaching a dance rather than on present accepted grade placement, teachers were asked to check the dance in the grade in which they thought it should be taught.

Two hundred five lists were returned. Two came from a director who checked the dances in the grades in which they were practiced in this city, thus reducing the total of choices. The other two hundred three lists expressed opinions of teachers. These were augmented by grade placement of folk dances in ten recently published city and state syllabi.

INTERPRETING THE DATA

In the following tables the highest number of votes given a dance for a grade determined its grade placement. The number given for the adjacent grades suggests its suitability or unsuitability for those grades. The sum of votes cast for a dance, given in "total for the grade" column, indicates its popularity or non-popularity. The last column shows how the dance ranked in popularity. The Arabic numerals after the folk dance or in the text refer to the bibliography given at the end of the article. Some dances were not well known, hence their low total. This does not mean that they were necessarily unsuited for a grade or disliked.

Obviously, some of the dances seem to suit more than one grade. Where the choices are equal or nearly equal in two grades, as in the Swedish Clap Dance and Ace of Diamonds in grades IV and V, the dance is placed in the grade which has the highest number of choices in the adjacent grade above or below.

Some folk dances show a spread covering four and more grades. For example:

1. Dutch Couples (not a folk dance)	from Grades		III - VII
2. Old Dan Tucker	"	"	VI - IX
3. How Do You Do	"	"	II - IX
4. Dutch Dance	"	"	III - VIII
5. Crested Hen	"	"	III - X
6. Come, Let Us Be Joyful	"	"	III - IX
7. Hop Mother Annika	"	"	III - VII
8. Ace of Diamonds	"	"	II - VII
9. Bleking	"	"	II - VII

Many others show a scattering of choices from grades II and III to VII. Why there should be found such a spread is difficult to explain. Two reasons suggest themselves for some of the narrower spreads of choices found. First, it may be true that the physical development of children of one community is superior to that of another. Second, teachers in some schools may devote more time to folk dancing than teachers in other schools.

If the folk dance is to serve educational ends, each dance should find its place in some school level where it is first to be taught and where it may be correlated with other subjects. This need not prevent its review in a higher grade for the fun of it. When this is done, the dance should be marked for review or for recreation.

TABLE I
CHOICES OF DANCES FOR GRADE III

	Grades							Popularity
	I	II	III	IV	V	VI	Total	
1. Children's Polka (9)*	1	19	45	17	3	—	85	4
2. Chimes of Dunkirk (9)	1	16	52	7	2	—	77	7
3. Cobbler Dance Austrian (5)	—	—	9	5	3	—	17	16b
4. Cobbler Dance Bohemian (5)	—	—	9	7	2	—	18	15
5. Cobbler Dance German (5)	—	1	18	8	2	—	29	13b
6. Carrousel (2)	1	5	60	13	5	—	84	5
7. Danish Dance of Greeting (2)	—	18	54	12	2	—	86	3
8. German Clap Dance (9)	1	2	29	12	3	—	47	10
9. Hand in Hand (17)	—	4	6	1	—	—	11	17
10. Hey Diddle Diddle†	1	7	18	1	—	—	27	14
11. Hot Cross Buns (12)	—	4	25	4	—	—	33	12
12. Indian War Dance (12)	—	—	25	17	8	5	55	9
13. I See You (2)	3	14	60	4	—	—	81	6
14. Jolly is the Miller (12)	—	16	54	12	8	7	97	1
15. Jump Jim Crow (12)	1	9	22	10	2	2	45	11
16. Looby Loo (4)	4	32	48	7	—	—	91	2
17. Nixie Polka (9)	—	3	46	17	3	2	71	8
18. Swiss May Dance (14)	—	—	10	7	—	—	17	16a
19. Yankee Doodle (17)	—	5	13	4	4	3	29	13a

* Arabic numerals in parentheses indicate the number of the reference, given at the end of the article, in which the dance is described.

† Crawford, Car. "Dramatic Games and Dances"; also in Moses, "Rhythmic Action, Plays and Dances."

Some dances with lower frequencies than the lowest given here were omitted. While the dances of the above table, according to the choices, are primarily suited for the third grade, there are a few that seem also to fit the second grade and two that might be placed either in the third or fourth grades.

TABLE II
CHOICES OF DANCES FOR GRADE IV

	Grades								Popularity
	I	II	III	IV	V	VI	VII	Total	
1. Bleking (3–4)	—	1	34	41	26	6	1	109	2
2. Captain Jinks (2–4)	—	3	16	37	20	6	4	76	4
3. Dutch Couples (4)	—	—	8	24	19	4	2	57	8
4. Green Sleeves (15–17) (English)*	—	—	2	11	6	4	2	25	9
5. Gustav's Skoal (4–3)	—	—	14	37	18	13	4	86	3
6. Hop Mother Annika (9)	—	—	13	32	12	4	4	65	7
7. Pop Goes the Weasel (4)	—	5	33	38	23	16	8	117	1
8. Rovenacka (2)	—	—	2	14	1	1	—	18	12
9. Seven Jumps (3–4)	—	—	8	21	18	13	4	64	6
10. Swart (5)	—	1	6	6	5	3	—	21	11
11. Swedish Clap Dance (3)	—	—	15	29	24	9	—	77	5
12. Swedish Ring Dance (9)	—	1	8	8	5	—	—	22	10

* Hinman, Mary Wood. *Gymnastic Dancing*, Volume III, A. S. Barnes & Co., 1922. Also in Buchanan, *Folk Dances and How to Do Them.*

The Swedish Clap Dance is also suitable for grade V. It was included in grade IV because there is a tendency toward more frequent use of the dance in grades below IV than in grades above V.

TABLE III
CHOICE OF DANCES FOR GRADE V

	Grades								Popularity
	II	III	IV	V	VI	VII	VIII	Total	
1. Ace of Diamonds (2)	1	16	42	40	23	7	—	129	1
2. Barn Dance No. 2	—	—	1	8	4	5	—	18	10
3. Csebogar (4)	—	6	30	37	28	16	—	117	2
4. Finnish Reel (16)	—	2	5	8	6	2	—	23	8
5. Hendricksa (5)	—	3	1	5	4	1	—	14	12a
6. Kača (4)	—	1	1	7	5	—	—	14	12b
7. Knytnapspolska (4)	—	—	1	7	6	1	—	15	11
8. Money Musk (4–10)	—	1	5	10	9	7	—	32	6
9. Mountain March (Norwegian) (2)	—	—	2	22	18	2	—	44	4
10. Ring Dance (14)	—	5	5	4	5	—	—	19	9a
11. Skobo Dansen (4)	—	—	2	5	4	—	—	11	13
12. Three Dance (4)	—	—	3	12	12	3	—	30	7
13. Troika (7)	2	7	14	15	7	3	—	43	3
14. Whirling Pop Corn*	—	7	4	8	—	—	—	19	9b

* Physical Education (Reprint of State Bulletin No. 36), Indianapolis Public Schools, 1924.

The Ace of Diamonds was placed in grade V rather than in grade IV because the total of choices above grade V (30) was higher than the total below grade IV (16). The closeness of the choices makes either grade IV or V suitable. Unfortunately, the popular Mountain March and Virginia Reel were omitted in the check list but were written in by 44 and 43 respectively. This explains their low total score. (For Virginia Reel see Table IV.)

TABLE IV
CHOICES OF DANCES FOR GRADE VI

	Grades									Popularity
	III	IV	V	VI	VII	VIII	IX	X	Total	
1. Ball Game (4)	—	—	—	18	11	3	3	—	35	18a
2. Clown Dance	3	5	4	17	12	6	4	—	51	14
3. Come, Let Us Be Joyful (3)	16	16	14	40	18	6	2	—	112	6a
4. Crested Hen (3–4)	7	11	21	48	31	12	5	3	138	2
5. Dutch Dance (4)	7	8	13	30	13	10	—	—	81	10
6. Gavotte (4)	1	2	6	22	8	2	3	5	49	15
7. How Do You Do (4)	17	10	12	46	14	3	6	3	113	5
8. Irish Reel (3)	—	11	10	37	23	17	4	2	104	7
9. Jumping Jack's Jubilee (4)	4	1	6	32	18	12	8	4	85	8
10. Kerry Dance (4)	—	—	8	13	10	6	3	1	41	16
11. Maypole Dance (2–9)	4	12	21	48	23	25	9	7	150	1a
12. Minuet in G (4)	4	12	22	47	24	20	14	7	150	1b
13. Noriu Miego, Lithuanian (1)	—	—	—	8	7	3	1	—	19	20
14. Oxen Dance (2)	—	—	—	21	15	9	8	8	61	13
15. Sailor's Dance	2	2	11	12	8	—	—	—	35	17
16. Sellinger's Round (4)	—	4	29	33	25	11	16	7	125	4
17. Sicilian Circle (4–10)	—	6	17	31	29	13	8	6	112	6b
18. Sleigh Bells	1	3	10	30	15	13	4	—	76	11
19. Strasak (2)	3	4	10	28	18	9	7	3	82	9
20. Tantoli (3)	2	16	14	52	27	14	5	2	132	3
21. Tinker's Dance (4)	—	2	7	15	6	2	—	—	32	18
22. Vineyard Dance (4)	5	5	13	33	2	2	2	1	63	12
23. Virginia Reel (4–9)	—	—	19	21	3	—	—	—	43	15½

All of the dances of this table unquestionably seem to belong in grade VI. Sellinger's Round has a fairly high frequency of choices in grade V, but the number above grade VI mark it distinctly for a grade above V.

TABLE V
CHOICES OF DANCES FOR GRADE VII

	Grades									Popularity
	III	IV	V	VI	VII	VIII	IX	X	Total	
1. Badger Gavotte (4)	—	3	7	10	11	—	—	—	31	11a
2. Bean Setting (4)	—	—	—	11	11	9	2	4	37	9
3. Black Nag (3)	—	—	—	11	16	14	12	6	59	5a
4. Frykdalspolska (4)	—	—	—	5	7	6	5	2	25	11
5. Gathering Peascods (9)	—	—	1	26	34	22	18	11	112	1
6. Hatter (1)	—	—	—	7	11	9	8	5	40	8
7. Highland Schottische (4)	—	—	2	17	34	32	11	5	97	4
8. Little Man in a Fix (4)	3	4	8	30	28	15	10	5	103	2
9. Mallebrok (4)	—	—	—	6	11	7	5	2	31	11b
10. Old Dan Tucker (10–1)	—	—	—	12	12	10	6	5	45	7
11. Peter Pan Schottische (9)	—	4	6	12	14	9	3	1	49	6½
12. Pirate's Dance*	—	2	3	5	6	—	—	—	16	13
13. Russian Scherr (4)	—	—	—	4	5	4	2	2	17	12
14. Sweet Kate (1)	—	—	—	15	19	14	9	1	58	5b

* Frost, Helen, "Oriental and Character Dances" (A. S. Barnes and Co., 1927).

Little Man in a Fix has been placed in grade VII because the total of choices above VII is so much greater than that below VI.

TABLE VI
CHOICES OF DANCES FOR GRADES VIII-X

	Grades							Popularity
	V	VI	VII	VIII	IX	X	Total	
1. Birdie in the Center (4)	—	5	5	6	3	4	23	15a
2. Country Gardens	—	5	5	10	4	2	26	13
3. Cracoviac (1)	—	6	10	14	6	2	38	10
4. Girl I Left Behind Me (4)	—	3	6	11	8	4	32	11
5. Highland Fling (2–4)	—	1	4	8	7	3	23	15b
6. Hungarian Czardas (2–4)	—	5	13	15	10	9	52	7b
7. Irish Lilt (4)	—	20	23	30	16	16	105	1
8. Irish Long Dance (4)	—	6	4	6	1	4	21	16½
9. Kamarinskaia (2)	—	6	15	24	12	13	70	5
10. Kolomyka (5–1)	—	1	5	7	5	4	22	16
11. Lancers (4)	—	1	6	6	4	7	24	14
12. Plain Quadrille (4)	—	7	12	17	13	10	59	6a
13. Portland Fancy (10–17)	—	8	9	6	8	4	35	12
14. Rheinlander (3)	—	3	4	5	2	1	15	18
15. Ritka (8)	—	2	13	17	11	2	45	9
16. Rufty Tufty (9)	—	17	18	21	17	7	80	4
17. Sailor's Hornpipe (3)	1	16	24	30	11	9	91	2
18. Spanish Couple Dance (9)	—	4	9	14	12	12	51	8
19. Tarantella (2)	—	13	19	27	17	11	87	3
20. Tatra (8)	—	2	4	5	7	2	20	17
21. University High (4)	—	3	13	19	16	8	59	6b
22. Varsovienne (10)	—	3	14	16	9	10	52	7a

The Portland Fancy has been placed in grade VIII because there are more choices for grades above VIII than below VII.

The Irish Lilt seems to be popular in grades VI, VII and VIII.

A Sailor's Hornpipe is also described in Reference 17.

The choices of a number of dances are so distributed that they could also be taught in grades IX and X.

CONCLUSION

From this investigation the following facts may be gleaned:

1. That many teachers, although from different parts of the country, agree on the grade in which certain dances should first be taught.

2. That this agreement is based on experience.

3. That there must be some law dealing with the parallel processes of growth of the child's organism and improvement in his coordinative powers.

4. And, finally, that folk dances placed in a physical education program according to the results of this investigation should be found suitable to the child's interests and abilities.

REFERENCES

1. Burchenal, Elizabeth, *Folk Dances of Old Homelands,* (New York: G. Schirmer, Inc., 1922).
2. Burchenal, Elizabeth, *Folk Dances and Singing Games,* (New York: G. Schirmer, Inc., 1933).
3. Burchenal, Elizabeth, *Dances of the People,* (New York: G. Schirmer, Inc., 1934).
4. LaSalle, Dorothy, *Rhythms and Dances for Elementary Schools,* (New York: A. S. Barnes and Co., 1926).
5. Shambaugh, Marie H., *Folk Dances for Boys and Girls,* (New York: A. S. Barnes and Co., 1929).
6. Chalif, L. H., *Folk Dances of Different Nations,* Volume I.
7. Chalif, L. H., *Folk Dances of Different Nations,* Volume II.
8. Chalif, L. H., *Folk Dances of Different Nations,* Volume III. (Published by author, 630 Fifth Ave., New York City.)
9. Rath, Emil, *Folk and School Dances,* (Published by Normal College, A.G.U., Indianapolis, Ind., 1929).
10. Ford, Mr. and Mrs., *Good Morning,* (Dearborn, Mich.: Dearborn Publishing Co., 1926).
11. Crawford, Caroline, *Folk Dances and Games,* (New York: A. S. Barnes and Co., 1908).
12. Neilson and Van Hagen, *Physical Education for Elementary Schools,* (A. S. Barnes and Co., 1937) p. 182.
13. Hinman, Mary Wood, *Gymnastic and Folk Dancing,* Volume II, (New York: A. S. Barnes and Co., 1922).
14. Crampton, C. Ward, *Crampton's Second Folk Dance Book,* (New York: A. S. Barnes and Co.).
15. Hinman, Mary Wood, *Gymnastic and Folk Dancing,* Volume III, (New York: A. S. Barnes & Co.).
16. Crampton, C. Ward, *Crampton's Folk Dance Book,* (New York: A. S. Barnes and Co.).
17. Burchenal, Elizabeth, *Folk Dances and Singing Games,* (New York: G. Schirmer, Inc.).

A Study of Factors Influencing Participation of College Women in an Elective Program of Physical Education

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PHYSICAL education is required of women students in 95 per cent of 154 representative colleges and universities in the United States according to a study reported in 1936.[11] * At the University of California, physical education was changed from a required to an elective subject in May, 1933. The students graduating in May, 1937, therefore, represent the first group whose entire experience in physical education in college has been with a wholly elective program. The response of this group affords a unique opportunity for the study of the operation of a physical education program organized on the elective basis.† Such a study assumes added importance in view of recent rather widespread discussion of the status of the requirement in physical education[1,2,4,7,10,11,12] and the speculations concerning the consequences of the removal of such a requirement.[6,7,10,11] An understanding of the reasons underlying the response of students to an elective program is of special significance. In the present study an attempt has been made to analyze the factors which have influenced the election of physical education by women at the University of California.

PROCEDURE AND ANALYSIS OF DATA

The general procedure in ascertaining and evaluating these factors may be summarized as follows: (1) selection of the students who had been in continuous residence at the University from August, 1933, to May, 1937, and division of this group into two smaller groups representing the extremes in regard to participation in physical education classes; (2) preliminary selection of probable and possible factors

* Refer to numbered Bibliography at end of article.

† At the University of California, academic credit may be received for physical education for eight semesters; the program of activities offered is varied; the gymnasium and field facilities are extensive, attractive, and convenient; all costumes and laundering of costumes, and equipment for almost all sports are furnished by the University from funds derived from the registration fee paid by all students; the average size of classes is about thirty, permitting individual attention to students by well-trained staff members. It is probable that conditions under which physical education is offered at this institution approximate the optimum. This should be kept in mind in the interpretation of data here presented. In an institution where no credit is given, special fees are charged, or facilities and staff are inadequate, the response of the students might be quite different.

which might affect the election of physical education; (3) examination of official records and personal interview of the students in the two smaller selected groups to obtain information relative to the problem; (4) analysis of the data to determine the operation of the various factors; (5) summary of student opinion with reference to a requirement in physical education.

In order to eliminate the variability of experience in college physical education of transfer students, and to hold constant the opportunity for maximum participation in the physical education program, only those students in regular attendance at the University from August, 1933, to May, 1937, were selected. Out of the total of 1,273 women in the graduating class, 365 had been in continuous residence during the four years. The complete physical education records of these 365 students were then studied. An analysis of these records gave the following results:

Per cent of students who took no classes in physical education	14.8
Per cent of students who took four or more classes in physical education	23.8
Mean number of classes passed per individual	2.32
Median of the distribution	1.89
Range of distribution in number of classes	0–10

From this analysis of the physical education records of the total group of 365 women, it was possible to select the two extremes with respect to participation in physical education. These groups were then subjected to detailed study in an effort to determine the factors of significance in the differentiation of the two groups.

The method used in obtaining the data was the interview, supplemented by study of official university records. An alternative method, the questionnaire, was considered, but the interview technique seemed superior in view of the nature of information desired. It was hoped that through personal interview with each student, complete information might be obtained concerning all possible factors, some of which might not have been suggested by the questionnaire. At the time of the interview, the student was allowed complete freedom in stating her reasons and opinions. A list of questions based upon factors selected for study was prepared, and notations were made by the interviewer, but an effort was made to avoid leading questions or suggestions.

Of the 54 students who took no classes in physical education, it was possible to interview 40. No selection of these students was made other than that imposed by the cooperation of the student and the possibility of arranging an appointment. Throughout this paper, this group will be referred to as Group N (*no* physical education). For comparison, an equal number (40) of the 87 students who had taken four or more classes in physical education were interviewed. In the selection of these 40 students physical education majors were eliminated, since for them

physical education activity courses were required rather than elective. The only other basis of selection was convenience of making an appointment for the interview. In this group, the mean number of physical education classes taken was 5.53. Throughout this paper, this group will be referred to as Group P (physical education).

From a survey of the literature,[2,4,10] and from opinions expressed by professional physical educators, the following factors were chosen for study as those most probably affecting the student's voluntary enrollment in physical education: (*a*) participation in athletic activities other than physical education classes; (*b*) participation in campus activities of a nonathletic nature; (*c*) participation in and attitude toward high school physical education; (*d*) outside employment; (*e*) health; (*f*) commuting; (*g*) major subject in college. A summary of the significance of the difference between the two groups in regard to these factors is given in Table I. A brief interpretation of the results obtained for each factor follows.

a) Since there are other opportunities than physical education classes for a college student to engage in physical activities, the factor of *participation in extracurricular athletic activities* was investigated. It was found that students who took classes in physical education also participated in the Women's Athletic Association program (W.A.A.), while students who did not take classes in physical education were not attracted by the activities offered by W.A.A. In Group P, 62.5 per cent of the students had participated in W.A.A. at some time during their four years in college, as compared to 15 per cent of Group N. This represents a critical ratio of 5, which is highly significant.*

In regard to participation in intramural activities and pleasure swimming, there is also a difference in favor of Group P. With respect to athletic activities off campus, there was very little regular participation during the college year by members of either group, and there is no significant difference between the two groups. With respect to participation in athletic activities during the summer, there is no difference in regard to the number in each group who participated *regularly*, but there is a reliable difference of 2.69 in favor of Group P in regard to the number of students who participated *occasionally*. It was found also that 22.5 per cent of Group N participated in *no* athletic activities during the summer as compared to 5 per cent of Group P. Thus, the conclusion may be offered that there is a coincidence between participation in elective physical education classes, and participation in other athletic activities on the campus. There are no facts to substantiate the suggestion that the majority of students who do not take physical education at the University are taking "adequate physical activity at

* If the Critical Ratio is at least 3.00, the difference is considered to be "certain beyond reasonable doubt" (99.8 chances in 100). If the Critical Ratio is between 2.00 and 3.00, the difference is considered to be "fairly certain" (97.9–99.8 chances in 100).[8]

TABLE I

SIGNIFICANCE OF THE DIFFERENCE BETWEEN GROUPS N AND P IN CERTAIN SELECTED FACTORS

Factors Selected	Critical Ratio*	Significance
1. Participation in extracurricular activities of an athletic nature:		Certain beyond reasonable doubt
a) At Hearst Gymnasium (i.e., pleasure swimming, W.A.A., intramural, etc.)	+ 4.1	
b) During school year other than at Hearst Gymnasium	0.0	None
c) During summer: Regular	— 0.5	None
Occasional	+ 2.7	Fairly certain
No participation	— 2.3	Fairly certain
2. Participation in campus activities of a nonathletic nature (i.e., publications, dramatics, committees, fraternities, elective offices, etc.):		
a) Membership in Prytanean (Women's Honorary Society based upon activities)	+ 2.0	Fairly certain
b) Membership in sororities	— 1.9	Slight
c) Membership in Phi Beta Kappa	+ 1.4	Slight
Group N: Total activities, 110; Mean, 2.75		
Group P: Total activities, 151; Mean, 3.77		
3. High School Participation:		
a) Participation in regular physical education in high school	+ 3.2	Certain beyond reasonable doubt
b) Favorable attitude toward physical education in high school	+ 1.6	Slight
4. Employment: Students employed at some time during college	+ 4.1	Certain beyond reasonable doubt
5. Health: Students "not qualified" or "restricted" for sports at entrance to University	— 2.6	Fairly certain
6. Commuting: Students commuting at some time during college	0.0	None
Students commuting 2–3 hours for four years	+ 1.4	Slight
7. Major subject in college	0.0	None

* Figures are plus or minus in relation to Group P. The formula [9]

$$\sigma_p = \sqrt{\frac{pq}{n}}$$

was used to determine the standard error of the proportion for each group, where p = the per cent of students participating, and q = the per cent of students not participating.

The formula [9]

$$\sigma_{P-N} = \sqrt{(\sigma_N)^2 + (\sigma_P)^2}$$

was used to find the standard error of the difference. The Critical Ratio is equal to the difference of the two percentages (per cent P — per cent N) divided by the standard error of the difference,[8] or

$$\frac{\text{Diff}_{P-N}}{\sigma_{diff}}.$$

Throughout this paper the difference figure will always be the per cent for Group P minus the per cent for Group N.

their homes, clubs, or otherwise away from the college campus." [10]

b) Data were obtained on the factor of ***participation in other campus activities*** in order to evaluate the suggestion that "the pressing demands on a student's time by other campus activities would tend to crowd out physical education if not required." [10] This suggestion is not supported by an examination of the facts, which were obtained from the student's own report of her activities and the student's record in the Blue and Gold (Senior Year Book). The mean number of campus

activities in which members of Group P participated is 3.77, as compared to 2.75 for Group N. In all activities studied except membership in sororities, Group P shows a larger percentage of student participation than Group N.

c) The experience of a student in *high school physical education* has been thought to be important in affecting the student's attitude toward physical education in college.[2,4] In studying this factor it was found that the number of students who definitely disliked physical education in high school was relatively small; there is no significant difference between the two groups in this respect. Likewise there is no difference in regard to a favorable attitude toward physical education, or an attitude of indifference. There is a significant difference, however, between the two groups in regard to the number of students who took part in regular physical education in high school for four years. Ninety per cent of Group P participated in regular physical education in high school, as compared to 62.5 per cent of Group N. This represents a critical ratio of 3.2, which is reliable. From this one might infer that students who have formed the habit of regular participation in physical education in high school will continue to do so in college, regardless of favorable or unfavorable attitude. The factor of health must also be considered here, as some students may have been physically unable to participate in physical activity, either in high school or college.

d) In regard to the factor of *outside employment,* there is a marked difference between the two groups. The data show that 55 per cent of Group P were employed at some time during the four-year college period, in comparison with 15 per cent of Group N, the critical ratio of the difference being 4.1. A corresponding difference is found between the two groups when employment during the entire four years, even to the amount of 40 hours a week, is considered. Thus, these figures indicate clearly that the student who worked, in addition to going to college, was more attracted to the elective physical education program than the student who did not work. These findings contradict the opinion that the student who is partially self-supporting does not have time for physical education unless it is required.[2,10]

e) The *health* of the student both at the time of entrance and throughout the four years of college, would seem to be an important factor in affecting the student's election of physical education. By an examination of the official health records of each of the 80 students interviewed, certain differences were found between the two groups.*

* These records are kept in permanent files at the Ernest V. Cowell Memorial Hospital, the University student health service. They were made available for this study through the courtesy of Ruby L. Cunningham, M.D., Associate Professor of Hygiene and Physician for Women. The analysis of the data is based upon the annual summary of health statistics made by the staff of Cowell Hospital, and follows a similar organization and terminology. Appreciation is expressed to Dr. Cunningham for helpful suggestions and supervision in this phase of the study.

According to data secured from the *medical examination at entrance,* 25 per cent of the students in Group N, as compared to 5 per cent in Group P, were classified by the examining physician as "not qualified" or "restricted" with respect to sports participation. There was no difference between the two groups in such factors as underweight, overweight, body build, previous operations or injuries, and painful menses. The fact that 25 per cent of Group N were given limited qualification for sports as compared to 5 per cent of Group P shows that this was an important factor in the election of physical education (Critical Ratio, 2.6). It was noted, however, when the records of the "restricted" students in Group P were examined, that one of the two students had taken physical education for seven, and the other for four, of the eight semesters. It may be assumed then that the program of physical education offered provided adequately for students in the restricted classification and, therefore, lack of opportunity for appropriate activity may be eliminated as a possible influence in the varied response of the two groups.

When a comparison was made between the two groups with respect to the *health record during the four years of college residence,* certain differences were noted. All but two of the 80 students had been treated at least once at Cowell Hospital. When the *number* of treatments or "patient's visits" was considered, however, it was found that members of Group P had made 1,151 visits as compared to 677 for Group N, a difference of 474 in favor of Group P. This difference is reflected in the average number of treatments per patient: for Group P, 28.8; for Group N, 17.8, and in the number of diagnoses: Group P, 219; Group N, 137.

Similarly, although the number of *patients hospitalized* was approximately the same for both groups, the total number of *hospital days* for Group P was 181 in comparison with 26 for Group N. This difference is reflected both in the average number of hospital visits per student (Group P, 3.5; Group N, 1.3), and in the average length of hospitalization (Group P, 5.66 days; Group N, 2.89 days).

In regard to the kind of ailments, Group P was found to exceed Group N both as to the number of students suffering from the ailment and the number of total diagnoses in the following ailments: respiratory infections, skin troubles, poison oak, and gastro-intestinal troubles. With respect to injuries and painful menses, Group N exceeded Group P. For other ailments, such as anemia, hay fever, heart trouble, malnutrition, poliomyelitis, insomnia, and giardia, there were too few cases in either group for any significant comparisons.

In interpretation of the data relating to dispensary treatments and hospitalization, it must be pointed out that several students in Group P were oustanding in their need for medical attention, and thus their records affect disproportionately the total figures for Group P. One of

these students had made 163 visits to the hospital during her four years in college, and had been hospitalized 7 times for a total of 47 days. The record of this student shows twice as many hospital days as the total listed for all the members of Group N. Another student in Group P was hospitalized 10 times for a total of 38 days. In reviewing the case histories of these two students, it was found that the former had taken physical education every semester of her college course except two, and the latter had taken four classes, two of which were upon the physician's recommendation. Both students reported health as the main reason for their election of physical education. (These are not the two students in Group P mentioned previously as being "restricted" in sports.) However, even when the records of these two students are omitted, the pendulum swings heavily to the side of Group P in regard to the need of dispensary treatment and hospitalization.

The findings may be interpreted in any one of the following ways:

1. The vigilance of the physical education department caused students registered for physical education to seek immediate attention at Cowell Hospital whenever their physical condition indicated the need of this service.

2. Students with physical handicaps tended to take physical education as a means of compensation, or in the hope of obtaining health.

3. Students who elected physical education were more aware of their own needs for medical advice and were more active in securing the needed help.

4. Students who were active in physical education, and also other campus activities, tended to lead a more vigorous life in all ways, came in contact with many more people, and thus may have had more chances for infection.

5. Students electing physical education responded in larger numbers to the health service as well as to the various other opportunities offered on the campus.

6. The health of a student was actually undermined by physical education and more medical attention was necessary because of overexertion and fatigue.

7. Students in Group N were treated by private physicians more often than students in Group P, a probability in regard to which the Cowell Hospital records could give no factual information.

f) It was found that the factor of *commuting* had relatively little effect on the students' decision to elect physical education. (A large percentage of students at the University of California live in San Francisco, Oakland, Alameda, El Cerrito, and other neighboring cities, and spend from one to three hours daily in going to and from the campus.) Although no attempt was made to equate the two groups in this respect, it happened that an equal number of students (18) in each group commuted to the University at some time during the four years. Closer inspection of the data shows that 22.5 per cent of the students who took no physical education spent from two to three hours a day for four years in commuting, in comparison with 10 per cent of the

members in Group P. However, this difference is not statistically significant, and one may infer that the factor of commuting is relatively unimportant in the election of physical education.

g) The remaining factor, that of *"major" subject* in college, proved to have no significance at all in regard to the election of physical education. Approximately equal numbers of students in the two groups were engaged in the fields of economics, science, art, history, and other major subjects. Thus, there seems to be no correlation between interest (and time spent) in certain academic subjects, and participation in physical education.

STUDENT OPINION

In addition to the objective factors discussed above, three indications of student opinion were investigated in this study, the main points of which will be noted here.

Attitude toward Requirement in Physical Education.—In the interview each student was asked: "If you were in a situation similar to that at the University of California, and were asked to vote on whether physical education should be required or not, how would you vote?" Of the 80 students so questioned, 60 students (Group N, 32; Group P, 28), or 75 per cent favored the elective program, the remaining 25 per cent favored the required program. This record of student opinion, based on a small number of students, contradicts that reported from institutions where the required program is in force.[10,12]

Reasons for Electing or Not Electing Physical Education.—Aside from the objective factors which have been analyzed in this study, there are presumably certain personal reasons which may influence a student's decision to elect physical education. Although there were many such reasons given by members of both groups, it is evident that the main difference between the groups is in the inherent *like or dislike of physical activity.* "Dislike for physical education" and "lack of interest," mentioned by 26 students, head the list of main reasons offered by members of Group N for not taking physical education, while "pure enjoyment" is given by 19 students of Group P as the initial reason for electing physical education. The students themselves found it difficult to explain *why* they had always liked sports and regular exercise, or *why* they were not "athletically minded." This lends support to the interpretation made above, that factors such as commuting, outside employment, and participation in campus activities are not of prime importance in influencing a student to elect or not to elect physical education.

Benefits to Be Derived from Elective Physical Education.—The 40 students who had taken physical education were questioned as to the benefits which they had received from their participation in the physical

education program. The majority of them reported "pure enjoyment and fun" as the chief value, saying simply that they had "had a good time." To some, it was the joy from big body movement and liberation of an overabundant supply of energy; to others it meant relaxation from study, long laboratory classes, or personal worries. Still others enjoyed the feeling of friendship, sociability, and freedom of the activity.

The values of health, vitality, education for recreation, social contacts, and pure enjoyment were mentioned by over 40 per cent of the students interviewed. Correct body mechanics, development of appreciation, financial benefits (preparation for positions in camps, etc.), leadership, and sportsmanship were mentioned by a small majority.

SUMMARY

For the groups studied, the following objective factors were significantly coincident with the election of physical education: participation in extracurricular athletic and nonathletic activities on campus, occasional participation in athletic activities during the summer, part-time employment, participation in regular physical education in high school, and qualification for sports at the medical examination given at entrance to college. The following factors were of little significance in the election or nonelection of physical education: favorable attitude toward physical education in high school, participation in athletic activities off campus, regular participation in athletic activities during the summer, major subject in college, and commuting.

The mean number of classes in physical education elected by students attending the university for four years was 2.32. Those students who made no attempt to elect a class in physical education represented 14.8 per cent, while 23.8 per cent elected four or more classes.

The students expressed the view that "pure enjoyment" was the main reason for electing physical education, while "dislike for physical education" and "lack of interest" were the main reasons for not electing physical education.

Students who took four or more classes in physical education made significantly greater use of the University health service than students who did not take physical education.

The opinion of the two special groups studied was in favor of an elective, rather than a required, program of physical education.

BIBLIOGRAPHY

1. Ainsworth, Dorothy S., *The History of Physical Education in Colleges for Women.* (New York: A. S. Barnes and Company, 1930) pp. 70–74.
2. Alden, Mabel Avis, "The Factors in the Required Physical Education Program That Are Least Attractive to the College Girl," RESEARCH QUARTERLY 3:4 (December, 1932) 97–107.
3. Barr, Margaret, "Résumé of the Physical Education Activity Program in Colleges for Women," RESEARCH QUARTERLY, 4:3 (October, 1933) 117–131.

4. Bullock, M., and F. D. Alden, "Some of the Factors Determining the Attitude of Freshmen Women at the University of Oregon toward Required Physical Education," RESEARCH QUARTERLY 4:4 (December, 1933) 60–70.
5. Elliott, Ruth, "Modern Trends in Physical Education," RESEARCH QUARTERLY 1:2 (May, 1930) 74–85.
6. Glassow, Ruth, "Basic Considerations in Planning the College Program for Women," RESEARCH QUARTERLY 1:2 (May, 1930) 110–118.
7. Graybeal, Elizabeth, "Measurements in Physical Education for Women," RESEARCH QUARTERLY 7:4 (December, 1936) 60–63.
8. Guilford, J. P., *Psychometric Methods.* (New York: McGraw-Hill Book Company, 1936) pp. 60, 61, 530.
9. Holzinger, Karl J., *Statistical Methods for Students in Education.* (Boston: Ginn and Company, 1928) pp. 240, 248.
10. Marshall, Violet B., "A Discussion of the Requirement in Physical Education for Women in Colleges and Universities," RESEARCH QUARTERLY 5:4 (December, 1934) 3–17.
11. Marshall, Violet B., "The Status of Physical Education for Women in Colleges and Universities," RESEARCH QUARTERLY 7:3 (October, 1936) 3–13.
12. Wiedamann, Inge von Lewinski, and Eugene C. Howe, "Undergraduate Attitudes and Interests with Regard to Physical Education Activities at Wellesley College," RESEARCH QUARTERLY 8:1 (March, 1937) 15–32.

Prediction in Physical Education

By Bryan Patterson

"A child must have a positive consciousness of what he is about, and be able to criticize his respective acts from the standpoint of their reference to the work he has to do." —John Dewey

"HOW much can I improve this score?" That is the question that should result in the mind of a pupil who has just completed a physical education testing program. As soon as the forward-looking individual knows his achievement rating, he will ask, "What can I do about it?"

If the individual has scored ***high***, he will want to know what his chances are for reaching someday outstanding levels of achievement. If the pupil has scored *low*, he will want to know how long it will take him to bring his score at least up to average levels of performance to remove him from the "dub" class.

The *average* individual may not be as much impressed as those persons at the extremes of achievement, and therefore not quite as deeply interested in his future promise as the high and low individuals. But many average-scoring individuals have some favorite activity in which they would like to develop more than ordinary skill. Such pupils will want to know if their hopes are in vain.

How can the question of individual prospective limits of future achievement be accurately answered by the physical education instructor?

This question can be answered through modern statistical methods and prediction techniques. Much progress is being made in other fields of education through the employment of such techniques, which can be used with equally effective results in the physical education program.

One of the better known methods of prediction of future possibilities is based on the regression equation. The chief advantage of this technique is that it not only predicts the "most probable score" of each individual, but also shows both the "probable variations" and the "possible variations."

A more simple method of prediction would be the use of general averages or scaled classifications, but these techniques involve generalizations which do not allow for individual differences in rates of improvement. On the other hand, the regression equation technique has a distinct advantage in that it employs probable errors of estimate which specifically provide for individual variations in improvability such as often arise due to special interests or extraneous influences.

The regression equation treats each case of prediction individually.

It shows the pupil three things:

1. His most likely score (with average effort under ordinary conditions of learning).

2. His highest possible score (with special efforts under optimum conditions of learning).

3. His possibilities for a low score (with little effort and with unfavorable learning conditions).

With real knowledge of the three possibilities of future achievement available, the forward-looking pupil will readily gain the conception that the amount of improvement that he will make in the future will not be gained automatically. He will then realize the improvement will vary according to his application, his efficiency in his training and practice, as well as according to his native ability.

By allowing for individual variations, the regression equation enables the physical director to help each of his pupils formulate individual goals which are not only within the reasonable reach of each individual, but are also definite individual challenges to effective training.

To test the real worth of prediction by regression equations in an active program, the writer carried on an experiment with a group of junior college students in Salt Lake City. The experiment tested the possibility of predicting improvement over a two-year period.

Records were taken over a total period of two school years on scores made in six items of motor activity, which were running, standing broad jump, throwing for distance, throwing for accuracy, pushups, and chinning the bar. To show prediction values, regression equations were developed for each item of activity. The technique used involved the computation of coefficients of correlation between beginning and final scores in each activity.

The score form of the regression equation which was employed in this study is as follows:

$$1. \qquad X - X' = r\frac{S.D._x}{S.D._y}(Y - Y').$$

In any given activity, according to this formula, X is the final score to be predicted; X' is the mean of all the scores at the end of the two-year period; r is the coefficient of correlation between scores at the beginning and at the end of the two-year period; $S.D._x$ is the final standard deviation; $S.D._y$ is the beginning standard deviation; Y is the known beginning individual score; Y' is the beginning mean of all scores at the start of the two-year period.

The expression $r\frac{S.D._x}{S.D._y}$, known as the regression coefficient, can be determined in value for any given activity and substitution made in the equation. The value substituted can be designated as z.

The mean scores of the two variables, *beginning ability* and *final ability*, may also be determined and their numerical values substituted in the formula. The regression equation (1) can then be cleared to read as follows:

2. $$X = zY - K.$$

Here K represents a constant value which is obtained through substitution in clearing the equation.

According to the above formulae, prediction relationships were found for each of the six items of motor achievement and are shown in the following table:

TABLE I

REGRESSION TABLE FOR SCORE PREDICTION
(For two years' college training)

Predicted Motor Ability	Regression Coefficient	Dependent Criterion	Constant Value	Probable Error of Estimate	Three P.E.est
X =	z ×	Y +	K	± P.E.est	(3 P.E.est)
Broad jump	.61	Beginning score	3.3	.247	.741
Running	.56	Beginning score	14.7	.58	1.74
Pushups	.40	Beginning score	20.0	2.50	7.50
Chinning	.57	Beginning score	6.5	1.62	4.86
Distance throwing	.68	Beginning score	12.0	2.01	6.03
Accuracy throwing	.27	Beginning score	8.8	1.46	4.38

Directions for Using the Table.—

1. Select activity to be predicted (first column).
2. Test individual in this activity and write score in Y column in place of "Beginning Score."
3. Multiply the beginning score (present score) by the corresponding value of the coefficient of regression (second column).
4. Add the value of the respective constant (fourth column).
5. The result is the most probable score with two years training.
6. In 50 per cent of the cases, the predicted score will not vary more than the amount indicated in "Probable Error of Estimate" (column five).
7. In 99 out of 100 cases the predicted score will not vary more than three times the probable error (last column).

If the present score of the individual is known for any of the six activities shown in the table, it is possible to find the most likely score of that individual two years hence, together with the probable and possible variations for that individual.

Thus to find the most probable score for a person in the standing broad jump, multiply the known score of that person's present broad jumping ability by z, or .61. Then add the amount K, or 3.3. The score thus obtained is the predicted score. It is the most probable score that the individual will make after two years of ordinary practice and training. This particular predicted score will have an even chance of varying not more than one $P.E._{est.}$ or more than .247 feet. The

chances are 99 in 100 that the individual's actual future score will not vary more than three times the $P.E._{est.}$ or more than .741 feet.

To illustrate the use of the table of prediction with a specific example, a boy entering college who can make a score of 6.8 in the standing broad jump can be predicted to jump, after two years growth and ordinary practice, .61 times his beginning ability of 6.8 plus a correction value of 3.3. The predicted score thus obtained will have an even chance of variation of not more than .247 feet. In short, this boy has a fifty-fifty chance of making between 7.2 and 7.6 feet. He will be practically certain to make a score between plus and minus three times $P.E._{est.}$ or between 6.6 and 8.2 feet.

In a similar way the predicted score in any physical education activity can be worked out. It is only necessary to know the statistical relationship between the sample achievement scores for the beginning and end of any interval over which prediction is desired. A definite picture of the individual's future possibilities is thus outlined. He knows what to expect and can plan and work accordingly. If the normally expected score is not as high as the individual would like to meet, he can hope to reach that mark with more than normal concentration only. It would not be sound planning for an individual to expect to make a score that was not within three probable errors of his normal predicted score.

To illustrate with another case, a boy who completes a running test in 35.0 seconds can be expected to run two years later in the time of 35.0 seconds multiplied by .56 plus the constant value 14.7, or in the time of 33.3 seconds. The possibilities are even that this boy will run between plus and minus one probable error or between 32.7 and 33.9 seconds. The possibilities are 99 in 100 that this boy will do no better than 31.6 or no worse than 35.04 after the two years practice and training. A boy who has definite ambitions can shape them wisely with the aid of the prediction technique, and the instructor can know what improvement he can reasonably expect and can evaluate progress logically according to individual variations.

In physical education, prediction relationships have not been very thoroughly or extensively determined. However, much progress is being made. With the rapidly increasing knowledge and facilities for statistical research, it is becoming possible to collect data sufficient to work out reliable prediction values for a wide range of activities.

The experiment reported here was limited in many ways, such as the following:

1. It dealt only with a comparatively small group.
2. It dealt only with one age level.
3. It dealt only with simple motor activities.
4. It does not compare training with no training.

Although limited in scope, it is the hope of the writer that this study will indicate the possibilities of prediction in charting individual progress in physical education. Perhaps the study will serve in offering a stimulus for further work along this line. It should be possible to work out prediction values for all stages of physical maturity. When this is done, it not only will be possible to offer interesting testing programs for self-rating and classification, but also to provide a *method of self-charting for future improvements.* It will then be possible to create in the minds of the children of all ages a forward-looking attitude like that recommended by John Dewey in the statement quoted at the beginning of this report. As Dewey indicated, there is a definite need for children to know where they are going. This applies to physical education as well as to all other education.

In physical education there are comparatively few guides which logically outline and chart the way of progress for each individual, or for groups of individuals. However, the work of Rogers, McCloy, Cozens, Neilson, and others has resulted recently in much advancement toward standardization of physical education achievement goals. Other physical education specialists are taking up the work, and by an accumulation of efforts along this line, it will eventually be possible for the physical instructor definitely to impress each individual with "a consciousness of what he is about," and to provide each pupil with prediction information to chart his own path, and to "criticize his respective acts from the standpoint of their reference to the work he has to do."

Abstract: A National Study of Incidence of Accidents in High School Wrestling, 1937-1938

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PROBLEM INVESTIGATED

THE purpose of this problem was to make a national survey of the incidence and causes of accidents in high school wrestling. The specific aim was to establish procedures for lowering the accident rate.

SOURCE OF DATA

The study was limited to:

1. A total wrestling squad enrollment of 4,620 high school boys.
2. One hundred twenty-six schools located in 12 states.
3. A survey of wrestling accidents between November 16, 1937, and March 8, 1938.

METHODS

The procedures used in the collection of the data involved two techniques: (1) receiving and coding of accident reports from high schools cooperating in the survey, and (2) the collecting of material relating to contributory factors, which was obtained through the use of questionnaires.

The accident report blanks were assigned a report number, coded as to institutional number, and assigned a code number for each item, in order that Powers cards might be prepared from the report blanks for tabulation.

The practices associated with the wrestling program were obtained from responses to questionnaires.

From the responses received on these questionnaires, an accident and days lost rate per thousand student participants was obtained for each of the high schools. All high schools reporting a similar response to a specific question were grouped together, their accident and days lost rate totaled, and the mean accident and days lost rate for a specific response determined. A critical ratio technique was used to compare the means of the accidents and the days lost in order to determine whether a real difference existed between the means.

FINDINGS

1. The current survey indicates that approximately 5 per cent of the total squad enrollment received injuries.

2. The average accident rate per school was 1.9; the average days lost per school was 13.5; the average severity rate per accident was 7 days. The accident rate per 1000 squad exposures was 52.5.

3. The greatest number of accidents and days lost occurred during the week of January 4 to 10.

4. The greatest number of accidents and days lost occurred during the first five minutes in practice, try-outs, and meets.

5. The fifteen- to the eighteen-year-old group accounted for the greatest number of accidents and days lost.

6. The greatest number of accidents and days lost occurred when the weight of the injured was less than the weight of the one causing the injury.

7. Mat burns on the knees and elbows, cartilage injuries to the ears, bone injuries of the ribs, and muscle injuries of the lumbar region accounted for the greatest number of injuries.

8. The greatest number of accidents occurred while the individual was working on his feet.

9. The greatest number of accidents was caused by injuries this season, while recurrences of old injuries had the highest severity rate.

10. Mats too small, defective mat covers, and lack of protection for the ears, were the causes of the greatest number of accidents.

11. The main designated causes of accidents were: improper equipment, lack of progressive training, and carelessness.

12. In most cases where either the athletic association or the administrative authorities paid all of the expenses of the injuries, the number of days lost per accident was a great deal lower than when the parents were required to pay all or part of the expenses.

13. Coaches who had more than six years of coaching experience had fewer accidents occur to their boys.

14. The employment of wrestling coach and physical education instructor would be the best method of minimizing the number of accidents and days lost.

15. The following suggestions were recommended by a majority of the coaches to reduce the number of injuries: larger mats, rubber-soled shoes, canton flannel mat covers, elimination of *pick ups* and *slams*, abusive use of *hammer lock*, elimination of *wrist locks*, dangerous weight reduction, proper conditioning, better preparation for coaches in training methods, more emphasis on students reporting minor cuts, abrasions and strains, more careful check on condition, and full-time team physicians.

16. Approximately 50 per cent of the schools provided entire wrestling equipment for their squad.

17. In the majority of cases the parents assumed all liability for the cost of the care of those injured.

18. In most cases a medical examination was given before preseason training or before the first meet.

19. The majority of coaches had five or more years of wrestling experience.

20. The majority of the schools had five or more weeks of training before their first interschool meet.

21. The customary number of days of preseason training before the first *intersquad* competition was either 6–8 days or 12–14 days.

22. Most schools practiced wrestling fundamentals three days per week.

23. The majority of schools devoted 10 to 30 minutes daily practicing wrestling fundamentals.

24. Trainers' or coaches' examinations were most frequently used to determine daily condition of wrestlers.

25. The usual practice employed by schools was to have a physician available for meets only.

26. The average cost per school for medical care for wrestling was $26.77.

27. Enough evidence pertaining to injuries is available to indicate that less time should be allowed "working on the feet," *especially* during split period bouts.

Sports in Which Men Over Age Twenty Engage

By M. V. Marshall and B. N. Nagle
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FOR a number of reasons, games and sports are an important matter today. Most people have more leisure today than people enjoyed a generation ago. So one of the problems confronting schools and other agencies that deal with youth is the provision of activities that will prepare them to use their leisure in constructive rather than debilitating ways. It is probable, too, that, for many people, the present-day mode of living is unhealthy. Many occupations are too sedentary to provide enough physical exercise to keep the body physically fit; or if they do provide exercise, this is often limited to exercising only certain parts of the body. And, again, the demands made by modern life as most people live involve undue nervous strain through overstimulation, hurry, and frustration of drives. Relaxation of tension and catharsis of aroused emotions are inadequately available to most of us. Sports provide a means of rectifying these maladjustments.

To secure information about the extent to which men over twenty years of age engage in sports, the study here reported was made. Information was secured from 259 men which permits the drawing of conclusions about their ages, the sports engaged in, regularity or otherwise of their exercise, and the extent of their attendance at school or higher institutions. In respect to education, the men represent a fair sampling: 15 per cent had an elementary school education; 34 per cent high school or preparatory school; 26 per cent college; 18 per cent beyond college; and 6 per cent other types of schooling. In two other respects the group is not representative: all of them lived in the city and a large proportion of them were teachers. No attempt was made at selection, however; respondents to the questionnaire were secured through personal acquaintance or contact by the junior author. So the selective factors that appear are purely fortuitous. And in spite of them, conclusions from our data will shed considerable light on the play habits of men over twenty.

TABLE I

Age	Number	Age	Number
20–24	46	50–54	20
25–29	50	55–59	9
30–34	37	60–64	16
35–39	31	65–69	5
40–44	23	over 70	5
45–49	17		
		Total	259

Ages of the group.—These are found in Table I.

It is seen that a fairly good-sized group in each age division was obtained, particularly below age fifty-five.

Regularity of Participation in Sports.—According to their own report, 33.6 per cent of these men engage in sports regularly, 41.7 per cent irregularly, and 24.7 per cent not at all. That is, only one-quarter of these 259 men do not engage in sports, and one-third engage in them regularly. When analyzed by age groups, the results in Table II were obtained:

TABLE II
PARTICIPATION IN SPORTS

Age	Regularly		Irregularly		Not at all		Total
	No.	Per Cent	No.	Per Cent	No.	Per Cent	
20–24	23	50	19	41.3	4	8.7	46
25–29	18	36	26	52	6	12	50
30–34	15	40.5	15	40.5	7	18.9	37
35–39	11	35.9	16	51.6	4	12.7	31
40–44	4	17.4	13	56.5	6	26.1	23
45–49	4	23.5	8	47	5	29.4	17
50–54	4	20	7	35	9	45	20
55–59	4	44.4	0	..	5	55.5	9
60–64	4	25	4	25	8	50	16
65–69	0	..	0	..	5	100	5
over 70	0	..	0	..	5	100	5

It is seen in Table II that the proportion of men who engage in sports regularly decreases with the higher ages and the proportion who do not engage in sports at all increases. If the figures regarding those who participate irregularly permit generalization at all, they tend to show that the proportion remains approximately constant up to about fifty, and then decreases.

Sports Engaged in.—As measured by frequency of mention, the most popular sports at all ages are swimming, tennis, and ping-pong. Golf and skating are close seconds. Baseball is the leading sport with men under thirty, and among the older men golf, quoits, and bowling take the lead. Table III shows the five or six most popular sports in each group with the frequency of mention for each.

TABLE III
FREQUENCY OF SPORTS

Sport	Age Group								
	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
Baseball	28	21		11					
Swimming	27	19	14	15	5	3	3		3
Basketball	26	16							
Tennis	25	18	17	12	9		3	1	
Skating	18		11	12		3			
Ping-pong		16	19	11	7	5	2	1	
Bowling		13			5		5		1
Golf			15	14	8	6	5		4
Quoits					5	3	5	3	5
Volleyball						3			
Gymnastics								2	1

Versatility.—In all, 29 sports were included in our list. Participation in some of these was evidently limited by facilities available or by custom. For, even among the 20-24 age group, there was no participation in fencing, polo, hockey, or squash. Indeed fencing was not participated in by a single one of the 259 men, polo was played by one man only, hockey by four, and squash by four.

The catalogue of sports engaged in by the 20-24 age group is a list of 25 different games and has the largest range for any age group. This range falls off gradually with increasing age, as is shown in Table IV.

TABLE IV
RANGE OF SPORTS

Age Group	Number of sports mentioned	Age Group	Number of sports mentioned
20–24	25	40–44	18
25–29	23	45–49	14
30–34	18	50–54	8
35–39	15	55–59	4
		60-64	5

The range of sports for a single man varies widely. The modal number of sports for a single man is three, but many have a wider range and for a few the number is more than ten, as given in Table V.

TABLE V

Number of Sports	Frequency	Number of Sports	Frequency
1	13	8	11
2	21	9	4
3	34	10	2
4	28	11	2
5	18	12	2
6	16	13	3
7	13	14	..
		15	1

The continuity of a sport through the different age groups varies with the sport. The most vigorous games are played by the younger men only. Some sports are popular among all ages. Table VI shows the continuity of the different sports as indicated by our 259 men. (X indicates that it was mentioned by one or more men in an age group.)

Schooling and Participation in Sports.—It might be suspected that attention given by schools and colleges to sports would be reflected in more participation in sports by those men who had more formal schooling. Table VI shows the percentage engaging in sports regularly, irregularly or not at all, of the men whose schooling had reached certain stages. The facts justify the conclusion: the more schooling, the more the participation in sports.

TABLE V

DISTRIBUTION OF SPORTS

Sport	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
Badminton	x	x	x	x		x			
Baseball	x	x	x	x	x				
Basketball	x	x	x	x					
Bowling	x	x	x	x	x	x	x		x
Boxing	x	x	x						
Captain Ball	x	x	x		x				
Cycling	x								
Field Events	x	x			x				
Football	x	x	x						
Golf	x	x	x	x	x	x	x		x
Gymnastics	x	x	x	x					x
Handball	x	x	x	x	x	x			
Hockey		x		x	x		x		
Horseback Riding	x	x	x	x	x	x	x		
Ping Pong	x	x	x	x	x	x	x	x	
Quoits	x	x	x	x	x	x	x	x	x
Rowing	x	x		x	x				
Skating	x	x	x	x	x	x			
Soccer	x				x	x			
Squash									
Swimming	x	x	x	x	x	x	x		x
Tennis	x	x	x	x	x	x	x	x	
Track	x	x	x			x			
Tumbling	x	x							
Volleyball	x	x	x	x	x	x			
Wrestling	x	x			x				

TABLE VI

SPORTS PARTICIPATION AND SCHOOLING

Schooling	Number of men	Participation in Sports		
		Regularly	Irregularly	Not at all
Elementary	41	31.7	24.3	44.0
J.H.S., S.H.S., Prep.	88	27.3	37.5	35.2
College or university	67	47.7	38.8	13.4
Beyond college	47	31.9	57.4	10.7
Other type school	16	18.8	75.0	6.2

OBSERVATIONS

The conclusions from the facts have been adequately stated above; to repeat them here would be redundant.

This study would provide more useful and reliable conclusions if it had taken into consideration some additional factors in the selection of the group. If attention were given to the occupations of the men, to their distribution in other areas than urban, and to the separation of the three variables of age, schooling, and participation in sports, more definite conclusions could be drawn. The present data do not permit this.

The wide diversity of sports that were mentioned suggests a basis

for scrutiny of the sports programs of schools, colleges, and community agencies. In addition to the twenty-nine sports given in the questionnaire, ten others were written in by individuals. It may be that the richness of play interests that this shows should have its counterpart in the organized sports of our institutions. Some light on the "carry-over" value of different sports also appears from this study that could be applied to organized sports programs.

How Much Do College Women Know About Syphilis and Gonorrhea?

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AUTHORITIES in the field of public health all agree that education of the public about the cause, modes of transmission, prevention, symptoms, treatment, etc., of the venereal diseases is essential if we are to be successful in the eradication of these diseases.

The American Youth Congress, which met at Milwaukee on July 5, 1937, discovered a "new youth problem"—the venereal diseases. This awakening interest is not sudden! One writer found that among fifty-three subjects on personal hygiene, the problem of the venereal diseases ranked seventh in the interest of 8,741 college students.[1] These students had been asked to designate, as their first choice, that division of personal hygiene which was of most value to them. This writer found that 672 women students of the 673 queried, answered "Yes" to the question, "Would you be interested in receiving more information about venereal diseases than you now possess?"

Despite the acknowledged need of public enlightenment, despite the interest in this very pertinent subject, these diseases, against which tremendous scientific advances have been made, are the diseases which still work destruction, because we fail to apply and disseminate this knowledge.

PURPOSE OF THIS STUDY

In consideration of (*a*) existing conditions regarding syphilis and gonorrhea, (*b*) acknowledged need of an informed public, and (*c*) student interest in this subject, this study attempted to discover:

1. The amount of knowledge about syphilis and gonorrhea held by female college students.
2. The kind of knowledge about syphilis and gonorrhea held by female college students.
3. Factors that might be responsible for this knowledge.
4. The implications of these factors when compared with the amount of knowledge.

DEVISING THE INSTRUMENT TO MEASURE THIS KNOWLEDGE

The securing of accurate data, upon which to base conclusions regarding the amount of knowledge about syphilis and gonorrhea held by

An abstract of a master's thesis, "A Study of the Knowledge of Syphilis and Gonorrhea Held by the Undergraduate Women of the Pennsylvania State College."

1 Delbert Oberteuffer. *Personal Hygiene for College Students.* (New York: Bureau of Publications, Teachers College, Columbia University, 1930), No. 407.

female college students and the factors that might be responsible for this knowledge, was based upon securing a valid and reliable instrument for measuring such knowledge and factors and applying this instrument to a large number of women students, representative of the group to be studied.

In view of these, as well as other necessary requirements, a true-false-doubtful test appendaged by a questionnaire was selected as the form best suited to the needs of this study. This contained one hundred true and false statements about syphilis and gonorrhea, obtained from the writings of recognized authorities on these diseases. Validation of the test items was based upon the opinions of medical, public health, and health education authorities as to the relative importance of each test item to the knowledge of the college girl. This test was found to be highly reliable as a measuring instrument of knowledge about syphilis and gonorrhea.

ADMINISTRATION OF THE TEST

The test was administered to 673 undergraduate women of the Pennsylvania State College: 272 freshmen, 261 sophomores, 92 juniors, and 48 seniors. This test, named "Knowledge Test of Syphilis and Gonorrhea," was objectively administered and scored.

FINDINGS

1. *On Basis of Length of Academic Training.*—The amount of knowledge about syphilis and gonorrhea increases as length of academic training increases; but this difference in average test scores is not very significant between freshmen and sophomore groups and between junior and senior groups.

TABLE I

COMPARISON OF GROUPS IN RESPECT TO THEIR AVERAGE SCORES MADE ON THE "KNOWLEDGE TEST OF SYPHILIS AND GONORRHEA"

Group	Number of Cases	Mean	S.D.	Diff._M	$\text{S.E.}_{\text{Diff.}}$	$\frac{\text{Diff.}_M}{\text{S.E.}_{\text{Diff.}}}$
Freshmen	272	50.09	12.03			
Sophomore	261	51.29	12.20	1.20	1.03	1.14
Freshman	272	50.09	12.03			
Junior	92	57.15	10.60	7.06	1.32	5.42
Freshmen	272	50.09	12.03			
Senior	48	59.17	11.65	9.08	1.83	4.96
Sophomore	261	51.29	12.20			
Junior	92	57.15	10.60	5.90	1.34	4.40
Sophomore	261	51.29	12.20			
Senior	48	59.17	11.65	7.88	1.84	4.28
Junior	92	57.15	10.60			
Senior	48	59.17	11.65	2.02	2.01	1.00

2. *On Basis of Source of Information.*—In general, any source of information, no matter how limited or superficial, showed appreciable value in the student's knowledge, as may be seen in Table II.

TABLE II

DIFFERENCE BETWEEN THE AVERAGE TEST SCORES OF GROUPS ON THE BASIS OF SOURCE OF INFORMATION

Factor	Number of Cases	Score	$Diff._M$	$S.E._{Diff.}$	$\frac{Diff._M}{S.E._{Diff.}}$
Formal instruction	274	55.78	7.05	1.01	6.98
No formal instruction	399	48.75			
Personal information	430	53.89	3.90	.98	3.99
No personal information	243	49.99			
Periodical information	521	53.70	9.40	1.06	8.87
No periodical information	152	44.30			

3. *On the basis of Religion.*—The average scores of the Protestant (mean grade 52), Jewish (mean grade 52.31), and Catholic groups (mean grade 49.24), respectively, show no differences great enough to indicate that religion is an influencing factor in the amount of knowledge held about syphilis and gonorrhea.

4. *On the Basis of Habitat.*—*a*) Students from urban communities (mean grade 53.71) know more about the venereal diseases than do students from rural communities (mean grade 50.25).

b) Students from industrial communities (mean grade 53.09) know more than students who come from communities which are residential (mean grade 51.69) or rural (mean grade 43.55).

c) Students from residential communities know more than students from rural communities.

5. *On the Basis of Professional Status of Fathers.*—Students whose fathers are of a professional status (mean grade 54.00) know more than students whose fathers are in other than professional occupations (mean grade 50.79).

6. *On the Basis of Response to Test Items.*—*a*) Deficiencies in knowledge about syphilis and gonorrhea are general and cannot be confined to any one phase of this subject.

b) Difficulty of the test item had no apparent relation to the number of correct student responses. It would seem that difficulty of the material is not an important factor in accounting for lack of knowledge.

c) The relative importance of test items, as ranked by authorities, had little relation to the number of students missing the items.

d) There is a greater lack of knowledge about both syphilis and gonorrhea than there are misconceptions, as evidenced by a comparison

between the percentage of incorrect responses and the percentage of doubtful responses to test items.

IMPLICATIONS OF THE FINDINGS

1. *On the Basis of Source of Information.*—*a*) A comparison of the mean group test scores between those receiving formal instruction and those receiving no formal instruction shows a significantly greater mean score for the former group. This would seem to imply that the subject of venereal diseases is worthy of being included in the school curriculum, especially in view of acknowledged need of enlightenment and the student interest in this subject.

b) If the individual reception of information from informed persons raises the mean test score, there seems to be some value in the dissemination of information through this medium.

c) The group receiving information through periodical literature attained a greater mean test score than those not receiving information from this source. This attainment seems to be indicative of the value of the dissemination of information about the venereal diseases through periodical literature.

d) A listing, as requested by the questionnaire appendaged to the test, of the periodicals through which information about syphilis and gonorrhea had been obtained, show that these periodicals were the more popularly read general magazines. This would seem to imply the value of disseminating more information about syphilis and gonorrhea in general, non-scientific periodicals.

e) The average test score is slightly greater for those who received formal instruction in addition to, or to the exclusion of personal and/or periodical information. This finding would seem to imply that the school is the most effective channel for the dissemination of information about syphilis and gonorrhea.

2. *On the Basis of Habitat.*—There is a necessity for increased dissemination of information about syphilis and gonorrhea in areas that are rural both as to type of occupation and population.

3. *On the Basis of Response to Test Items.*—*a*) The general deficiency in knowledge may be due to a number of factors such as (1) insufficient emphasis or complete omission of this subject in the school curriculum, (2) lack of home and community instruction, and (3) narrow scope in reading. All of these factors were taken into consideration in this study and were found to be important. There seems to be a need for (1) additional emphasis in the school curriculum, (2) increased home and community instruction, and (3) increased scope in reading made possible through increased dissemination of information, particularly through the medium of popular magazines.

b) Increased emphasis, in disseminating information to female col-

lege students, on those test items that authoritative opinion has deemed "most important."

CONCLUSIONS

Within the limitations of this study, the findings seem to warrant the following conclusions:

1. There is an insufficient emphasis upon, or a complete omission, of the subject of venereal diseases in the school curriculum.

2. There is a partial or entire lack of home and community instruction about the venereal diseases.

3. There is a narrow scope or entire lack of reading about venereal diseases.

4. Factors one, two, and three seem to be in greater evidence in rural areas.

5. Formal instruction has slightly higher value as a source of information than personally transferred or periodical information.

6. Religion is not a significant factor in the amount of knowledge held about syphilis and gonorrhea.

7. This study indicates certain factual information that needs additional emphasis in the organization of a unit of instruction about the venereal diseases.

8. This study indicates certain factual information that needs additional emphasis, in the enlightenment of the general public, through all of the media of mass education.

TWENTY OF THE ONE HUNDRED STATEMENTS APPEARING ON THE "KNOWLEDGE TEST OF SYPHILIS AND GONORRHEA," AND STUDENT RESPONSE TO EACH OF THE ITEMS.

R	W	D*	Question
609	20	44	1. Treatment of syphilis, even if recognized, cannot be begun in the primary stage. (F)
435	38	200	2. Syphilis frequently causes heart disease. (T)
374	60	239	3. Congenital syphilis can be prevented. (T)
332	118	223	4. Treatment of syphilitic mothers during the early months of pregnancy results in healthy non-syphilitic children in almost all cases. (T)
480	47	146	5. The syphilitic individual can sometimes successfully treat himself. (F)
290	165	218	6. Syphilis and gonorrhea are different manifestations of the same disease. (F)
236	322	115	7. Syphilis is almost always contracted through sexual intercourse. (T)
243	24	406	8. During the period of the chancre, syphilis is not contagious. (F)
137	240	296	9. The skin eruptions, which appear in the second stage of syphilis, disappear without treatment. (T)
87	387	199	10. The best time for treatment of syphilis is when the organism is discovered in the blood. (F)
329	224	120	11. The cause and methods for diagnosing and treating syphilis are now known. (T)
290	80	303	12. The chancre, the primary stage of syphilis, may appear on any part of the body. (T)
405	13	255	13. Syphilis is one of the chief causes of stillbirth. (T)

R	W	D*		Question
400	30	243	14.	It takes about two years or longer to treat early syphilis and an indefinite period to treat late syphilis. (T)
240	108	325	15.	Syphilis is most contagious in its early stages. (T)
329	30	314	16.	The discharge of pus from the external reproductive organs is one of the symptoms of gonorrhea. (T)
456	49	169	17.	Gonorrhea is one of the least serious of the infectious diseases. (F)
205	48	420	18.	A person cannot have syphilis and gonorrhea at the same time. (F)
433	34	206	19.	Sterility is a frequent result of gonorrhea. (T)
156	87	436	20.	After adequate treatment and the disappearance of all evidences of gonorrhea, recurrence of the disease is rare. (F)

* R indicates correct response; W indicates incorrect response; D indicates the subject was doubtful or did not know the correct response.

Medical and Physical Education Examinations of Freshmen and New High School Students in the Public Schools of Seattle, Washington, School Year, 1937-1938

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DISCUSSIONS relative to the health of American high school students are commonplace among educators and physicians. There has been much speculation regarding the merits of various physical education programs, but little of it has been based upon statistics gathered through physical examinations. To provide such information as is necessary for a comprehensive study of the situation, the Medical Department of the Seattle Public Schools has developed a project providing physical examinations for all freshmen and newly matriculated students in its nine high schools. These examinations are made for the purpose of classification of students for physical education. The object of the examination is to procure information for the schools regarding each pupil's mental and physical capacity and endurance. This information leads to placement of pupils in classes where physical exercise will be beneficial and free from the possibility of injury.

These examinations are completed as rapidly as possible after the beginning of each semester. They are conducted jointly by a physician from the School Medical Department and the physical education instructor. A man physician examines the boys and a woman physician examines the girls. The physical education instructor checks the height, weight, nutrition, posture, and general body mechanics. The physician makes the physical examination. After a brief conference between the two examiners, each boy or girl is classified for physical education. Classes are then arranged for general, general but limited, individual, and rest programs. Rechecks for reclassification are made as they are found necessary.

In the year 1937–1938, all freshmen and new students in the high schools were examined and classified for physical education as follows:

Type of Physical Education Program	*Boys*	*Girls*	
1. General program	2141	1646	
2. Limited general program	824	621	
3. Individual program	48	170	
4. Rest	44	56	
	3080	2493	
Total number of students examined			5573

The findings of the examinations which lead to the above classifications are listed below:

Posture	*Boys*	*Girls*
1. Excellent	175 (6 per cent)	425 (17 per cent)
2. Good	1514 (50 per cent)	1225 (49 per cent)
3. Poor	1185 (37 per cent)	768 (31 per cent)
4. Bad	196 (7 per cent)	75 (3 per cent)

Causes of Postural Classification		
1. Flat chest	112	37
2. Funnel chest	45	15
3. Pigeon chest	50	42
4. Low shoulder	349	69
5. Round shoulder	224	120
6. Winged scapulae	83	51
7. Spinal curvature	206	526
8. Flat feet	509	244

Disabling Diseases	*Boys*	*Girls*
1. Heart disease	33	44
2. Infantile paralysis	12	17
3. Asthma	19	?
4. Cerebrospinal meningitis	7	2
5. Rheumatic fever	11	6
6. Encephalitis	1	1
7. Diabetes	1	2
8. Athletes foot	153	221
9. Arrested tuberculosis	8	12
10. Epilepsy (mild)	1	0
11. Appendicitis (not operated upon)	1	46
12. Dismenorrhea		336
13. Spastic paralysis	7	6
14. Thyroid	1	40
15. Eczema	3	0

Disabling Conditions	*Boys*	*Girls*
1. Wearing glasses	494	368
2. Marked Obesity	75	97
3. Excessive underweight	106	317
4. Loss of vision (one eye)	8	0
5. Marked impairment of hearing	3	4
6. Congenital club feet	3	4
7. Contractures from burns	4	0
8. Amputation of fingers	8	1
9. Amputation of toes	2	0
10. Amputation of foot	1	0
11. Amputation of leg	1	0

Conditions Needing Surgical Attention	*Boys*	*Girls*
1. Tonsils and adenoids	147	132
2. Hernias	34	4
3. Crossed eyes	7	5
4. Chronic appendicitis	1	46
5. Thyroid	2	3

In addition to the information sought relative to the physical education classifications, other interesting facts were revealed which furnish leads towards further evaluation of the health status of American youth. Interesting, indeed, is the history of sickness and injury. In reviewing the history of these, one is impressed by the realization that affairs have not always been well with our children. It was found that among these 5573 students, the following gave histories of accidents and sicknesses which left no disability:

Fractures (*non disabling*)	*Boys*	*Girls*	*Fractures* (*non disabling*)	*Boys*	*Girls*
1. Arm	329	92	4. Nose	47	2
2. Leg	102	21	5. Skull	19	11
3. Clavicle	69	8	6. Vertebra	2	0

Operations (*non disabling*)	*Boys*	*Girls*	*Operations* (*non disabling*)	*Boys*	*Girls*
1. Tonsils and adenoids	1715	1276	6. Pylaric stenosis	7	0
2. Appendicitis	154	109	7. Cleft lip	1	1
3. Mastoid	61	50	8. Cleft palate	1	0
4. Hernia	38	2	9. Hemorrhoids	1	0
5. Rib resection	14	12			

Serious Illnesses (*non disabling*)	*Boys*	*Girls*	*Serious Illnesses* (*non disabling*)	*Boys*	*Girls*
1. Pneumonia	195	176	7. Malaria	4	2
2. Diphtheria	47	41	8. Septicemia	2	4
3. Smallpox	14	12	9. Tetanus	1	0
4. Nephritis	13	12	10. Infantile paralysis	15	14
5. Typhoid	10	9	11. Encephalitis	10	8
6. Erysipelas	4	2			

COMMENT

The information regarding the physical findings gained by these examinations may be accepted as complete because it was collected by skilled pediatricians. As one contemplates the lists of disabilities, one sees their value to the formulation of programs involving physical development and rehabilitation.

The information regarding the history of injuries and illnesses must not be accepted as complete because it was recorded solely from statements made by pupils who were in all probability not able to recall all injuries and illnesses. However, it is a challenge to preventive medicine.

Physical education departments of American high schools are undergoing tremendous development. Dependable information regarding each student's physical condition is necessary if there is certainty that none will be injured and all will be benefited.

Two Studies in Swimming Starts

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I. The Use of Starting Blocks in Swimming Sprints

IT HAS been the custom for many years for sprint runners to employ a starting aid. Only until recently they used holes dug in the track as a means of bettering their start. However, a few years ago, starting blocks, spiked to the top of the track, were introduced and are now recognized as legal equipment. That the blocks on top of the track gave a sprinter an advantage in the start has been demonstrated by Hayden and Walker[1] who proved that sprint runners using supports on top of the track gained a time advantage in their start.

It has always been the custom for swimmers to start from a flat-footed position on the edge of the pool. The success which sprint runners met with the use of starting blocks on top of the track suggested the idea that a starting block might be an advantage to the swimmer. In order to prove the value of starting blocks in the swimming start, the investigation herein reported was carried out. It is the purpose of this investigation to determine if starting blocks affect the starting time of swimmers in leaving their mark by giving them either an advantage or disadvantage at the start.

Definition of Starting Time.—Starting time as used in this experiment is defined as the interval elapsing between the pistol shot and the time the swimmer leaves his mark.

The Apparatus.—The apparatus consists of a (1) stimulus unit, (2) a response unit, and (3) a recording device.

1. The stimulus unit. The stimulus unit consisted of a Dunlap sound key placed in series with a storage battery, a relay, and the starting magnet of a Dunlap chronoscope. Since the sound key keeps the circuit closed, it is necessary to employ a relay. The operation of the stimulus unit consisted of firing a pistol, thus opening the circuit for an instant. During this time, the relay closed the chronoscope magnet circuit, thus starting the dial hand.

Since the sound key itself is standard equipment, and since its effi-

[1] T. C. Hayden and G. A. Walker, "A Comparison of the Starting Time of Runners Using Holes in the Track and Starting Blocks," RESEARCH QUARTERLY, 4:2 (May 1933) 117–123.

ciency has been proved by Tuttle and Bresnahan,[2] it is not described in detail.

2. The response unit. The response unit consisted of a starting block for use on the flat, and a support which elevated the heels of the swimmer. The support was equipped with electric contacts so that when the swimmer stood on the support the circuit was open, but as soon as he left his mark the circuit was closed. This was accomplished by placing stiff springs under the top surface of the supports. The supports were made of wood and equipped with iron straps so that they fitted tightly over the ledge of the pool.

The block which yielded a start in the same position as if no block were used was a flat board strapped to the ledge of the pool, equipped with contacts as previously described. The starting block consisted of a flat board, the back edge of which was elevated so that the front edges met the pool ledge at an angle of 20 degrees.

The technique for recording the response consisted of having the swimmer leave his mark in the orthodox manner when the pistol was fired. The response circuit consisted of the starting block in series with a storage battery and the "stop" magnet on the chronoscope. Since this is a "make" circuit no relay is necessary.

When the pistol was fired the swimmer left his mark thus allowing the response circuit to be closed by the springs underneath the support. This stopped the chronoscope recording hand.

3. The recording unit. Time was recorded by means of a Dunlap chronoscope which is standard laboratory equipment. Time was recorded in milliseconds (1/1000 sec.).

The swimming start was executed in the usual manner. The signals were "get on your mark," and then the "pistol shot." The time elapsing between the command and the gun was classified as a "fast gun," but the interval was always varied so as to prevent a learned response.

When the pistol was fired, the sound key activated the relay, thus starting the chronoscope dial hand and when the swimmer left his mark, the response circuit was closed, thus activating the stop magnet on the chronoscope and consequently stopping the dial hand. Since the chronoscope dial is calibrated in milliseconds, the starting time was read directly from the dial.

The accuracy of the chronoscope as a means of measuring time has been demonstrated by Graflund.[3] It was shown that although there was a small lag in the apparatus, yet it was always constant. Since this experiment is dealing with comparative figures and not absolute time, no allowance was made for this error.

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[2] W. W. Tuttle and G. T. Bresnahan, "An Apparatus for Measuring Starting Time in Foot Races," RESEARCH QUARTERLY, 4:2 (May 1933) 110-116.

[3] Fred A. Graflund, "A Study of the Correlation Between Mechanical and Stop-Watch Timing in the Dash Events," *Athletic Journ.*, 17 (Sept. 1936) 1-5.

Collecting the Data.—Data were collected from all the available varsity swimmers at the University of Iowa, the group numbering eighteen. The records were made during the regular practice schedule, so the starting times were taken under favorable conditions. Each individual was properly warmed up and the experiment was done under the supervision of the coach.

Each swimmer took twenty starts from the "flat," and a like number from the starting block. Since forty starts were more than it was felt advisable for a swimmer to take in one period, several periods were employed for the experiment. However, in each experimental period the same number of starts were taken from the "flat" and from the support. The order of starts was at random, thus avoiding a regular sequence of starts from any position.

Since the whole group was well trained in swimming, each had already established his starting stance. In view of this fact each swimmer was allowed his natural stance at the start.

The Data.—A summary of the data collected is shown in Table I. In the Table the differences, the probable errors of the differences, and their significance are shown.

An examination of Table I shows that in every case except one, the starting block was a disadvantage. In case 16, it was no advantage.

TABLE I

THE MEAN STARTING TIME OF EIGHTEEN SPRINT SWIMMERS USING BLOCKS AND STARTING FROM THE FLAT

(The time is in seconds)

Sub.	Flat		Blocks			P.E. diff.	Diff.	Signif.
no.	Mean	P.E.	Mean	P.E.	diff.		P.E. diff.	Diff.
1	.225	.0563	.384	.0429	.159	.0708	2.245	93
2	.315	.0417	.502	.0660	.187	.0781	2.394	95
3	.317	.0391	.392	.0449	.085	.0595	1.428	83
4	.325	.0530	.392	.0707	.067	.0884	0.758	71
5	.500	.0495	.679	.0737	.179	.0888	2.016	91
6	.283	.0368	.333	.0434	.050	.0569	0.879	73
7	.552	.0433	.645	.0929	.093	.1025	0.907	73
8	.400	.0494	.431	.0526	.031	.0722	0.429	62
9	.358	.0322	.566	.0645	.208	.0711	2.925	97
10	.398	.0424	.488	.0617	.090	.0749	1.202	79
11	.417	.0403	.464	.0764	.047	.0864	0.544	64
12	.409	.0451	.605	.1198	.196	.1289	1.521	84
13	.438	.0442	.525	.0712	.087	.0838	1.038	76
14	.386	.0741	.526	.1014	.140	.1252	1.118	77
15	.335	.0558	.412	.0688	.077	.0886	0.869	72
16	.440	.0703	.434	.0534	−.006	.0761	−0.079	53
17	.280	.0425	.425	.0499	.145	.0655	2.214	92
18	.437	.0575	.530	.0611	.093	.0636	1.462	84
Mean	.397±	.0585	.485±	.0539	.088	.0796	1.106	78

The Reliability of the Data.—The sum of ten odd-numbered starts on the flat surface was correlated with the sum of ten even-numbered starts on the flat surface; and the sum of ten odd-numbered starts on

the starting block was correlated with the sum of ten even-numbered starts on the starting block. The reliability coefficient for the flat surface was .954 and for the starting block .964.

Discussion.—Considerable experimentation was carried on relative to the proper angle for the starting block. In the beginning three supports were made. One had an angle of 10 degrees, one 20 degrees, and one 30 degrees. The use of these supports taught us that 10 degrees was so small that it promised little advantage should supports prove to be an advantage. Thirty degrees was too great an angle since the swimmer had difficulty in maintaining his balance while standing on it. It was finally decided to employ a support with as great an angle as was consistent with good balance. The final report proved the adoption of the 20-degree angle.

Although the number of subjects may seem small, the fact that all of them were highly trained swimmers and that the results were consistent leads us to believe that the experiment is conclusive.

The reason why starting blocks for swimmers gave them a time disadvantage is not entirely clear. The reason may be that the inclined base of support induced inefficient mechanics which would be responsible for the lack of advantage.

SUMMARY AND CONCLUSIONS

Data were collected from eighteen well-trained swimmers to determine if starting blocks gave them a time advantage in getting off the marks at the start of the race. The evidence showed quite conclusively that starting blocks are a disadvantage to swimmers in leaving the mark at the start of a swimming race, as far as starting time is concerned.

II. The Optimum Time for Holding a Swimmer on His Mark

It is a well-known fact that the interval of time that a starter holds swimmers on their mark, in competition, is subject to individual variation. One who attends swimming meets is sometimes struck by the short interval allowed the swimmers to get ready for their start. On the other hand, in many instances, the holding time is so long that the swimmer has passed his peak of readiness and his attention is no longer fully concentrated on the pistol shot. It is commonly admitted that either too short or too long a holding time is undesirable. Prompted by the work of Walker and Hayden[1] concerning the optimum time for holding a sprinter between the command "get set" and the pistol shot,

[1] G. A. Walker and T. C. Hayden, "The Optimum Time for Holding a Sprinter Between the Set and the Stimulus (Gun Shot)," RESEARCH QUARTERLY, 4:2 (May 1933) 124-130.

the present investigation was undertaken in order to determine whether or not there is an optimum time for holding swimmers on their mark.

The Criterion for Optimum Time.—Wherever studies have been made on the correlation between speed over short distances and starting time in races, the results have shown that a fast start is conducive to short racing time. In view of this fact, the criterion used in attempting to find the optimum holding time in the swimming start is that interval of time elapsing between the instant the swimmer has assumed a position with both feet on the take-off board and the pistol shot, which yields the fastest starting time.

Definition of Starting Time.—Starting time in swimming, as used in this investigation, is the interval of time elapsing between the pistol shot and the act of leaving the mark by the swimmer.

THE TECHNIQUE

The apparatus employed consists of (1) a sound key circuit for recording the time of the pistol shot, (2) a specially devised take-off board for indicating the time the swimmer leaves his mark, and (3) a recording camera. The arrangement of the apparatus is shown in Fig. I.

1. *The Signal Circuit for Indicating the Time of the Pistol Shot.*—In order to record the instant the pistol is fired, a Dunlap sound key

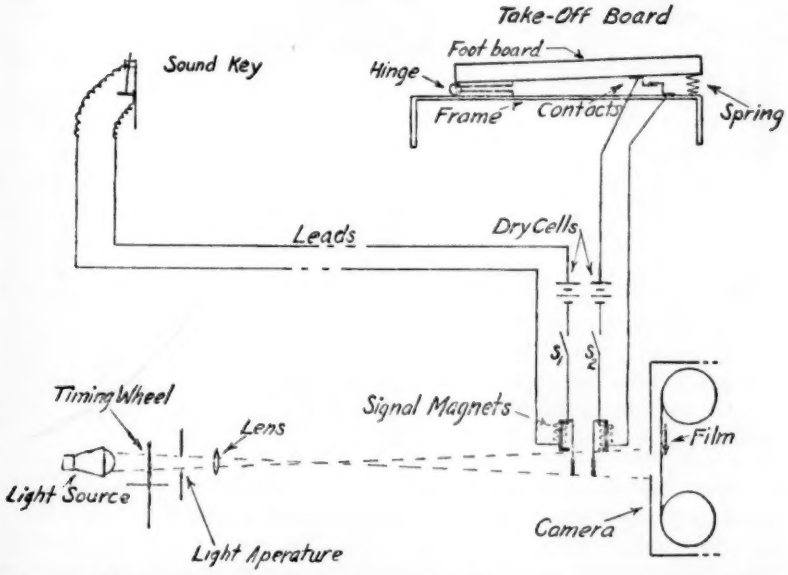

FIG. 1. This figure shows the arrangement of the apparatus used for determining the time elapsing between the "gun" and the leaving of the mark by a swimmer.

is employed. The sound key is placed in series with a signal magnet and two dry cells. When the pistol is shot, the sound waves activating the sound key instantaneously break the circuit, thus causing the signal magnet to move. This is recorded on the sensitized film, as the beginning of the starting time.

2. *The Take-Off Board.*—For the purpose of indicating the time when the swimmer leaves his mark, a take-off board was devised. It consists of two boards, 18″ by 12″, hinged together at one end. The boards are equipped with contacts for making an electric circuit. A coiled spring is placed between the boards for the purpose of holding them apart (Fig. 1). When the swimmer takes his mark, his weight forces the boards together, thus keeping the contacts open. As soon as he leaves his mark, the spring brings the contacts together, thus closing the circuit. The contacts are in series with two dry cells and a signal magnet. When the swimmer leaves his mark, the circuit is closed, thus activating the signal magnet. The movement of this magnet is photographed as the end of the starting time. The take-off board is equipped with guides so that it fits snugly over the edge of the pool. The board cannot slip, and, when covered with a wet towel, presents a situation which cannot be distinguished from the regular take-off surface.

3. *The Recording Camera.*—The camera used for recording in this experiment is similar to the standard equipment used for photographing electrocardiograms. Since the time interval involved is short, it was necessary to increase the speed of the camera so that it pulled the recording paper through it at the rate of about 12 inches per second. In order to record time in 1/100 sec., the 5-spoked disk on the synchronous motor was replaced by one containing 20 spokes. Since the motor was activated by a 50 d.v. electric tuning fork, this arrangement cut 100 vertical lines per second across the recording paper. A light source placed back of the timing device was projected on the aperture of the camera. The spokes in the revolving wheel were focused on the recording paper by a 20 diopter lens. The signal magnet styli were placed side by side in front of the aperture of the camera. They were focused on the recording paper by means of a lens in the aperture of the camera.

All starting was done by an experienced starter. The various holding times were measured by a 1/10 sec. stop-watch. By practice the starter learned to shoot the pistol at the end of the designated period, measuring the time with the watch.

The Record.—The record was photographed on 35 mm. Eastman recording paper No. 1. The paper is furnished in 200-foot rolls. When everything was ready, the starter called the swimmer to his position. The source light was turned on and the camera started. As soon as the swimmer had assumed a position with both feet on the take-off

board, the watch was started, and at the end of the designated interval the pistol was fired. The various holding intervals were never presented in the same order, but always at random. This avoided the possibility of the swimmer's guessing the interval and jumping the gun. Only legal starts as defined by rules were recorded.

A record obtained by the technique employed is shown in Fig. 2. The top line on the record is made by the stylus of the signal magnet

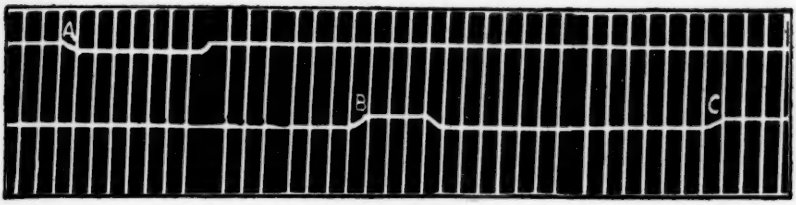

FIG. 2. This is a reproduction of a record used for determining starting time in sprint swimming. A, the "gun;" B, crow-hop; C, leaving the mark. The vertical lines represent time in 1/100 sec.

in series with the sound key. The break in this line at the left margin of the record indicates where the pistol was fired. This break is due to the opening of the circuit. As soon as the circuit is closed the signal magnet returns to its original position as shown by the second break in the top line.

The lower line is made by the shadow of the signal magnet stylus in series with the take-off board. In a number of cases a swimmer, in starting, goes through a movement commonly known as the "crow-hop." Evidently, in order to gain more velocity, he lifts his weight off the mark, coming down again before he leaves the board. The first break in the lower line in the record presented indicates when the crow-hop was performed. This is a short interval indicated by a quick "make" and "break" of the circuit. The break in the bottom line farthest to the right indicates where the swimmer finally left his mark. The vertical lines on the record are caused by the shadows of the spokes in the timing wheel. Since the spokes in the wheel cut the beam of light at the rate of 100 times per second, it is obvious that the space between two vertical lines represents 1/100 sec. It should be noted also that the twentieth spoke in the wheel is omitted. This produces a space twice as wide as the others, every fifth-second. This was done in order to facilitate the reading of long records.

It should be stated that a considerable part of the record which contained only time marks was cut from the record presented due to the fact that space would not permit including it. It is obvious, however, that by counting the number of vertical lines between the first break in the upper line and the last break in the lower line, the time consumed in starting can be calculated in 1/100 sec. By interpolation, the time can be carried to the third decimal.

In the record presented in Fig. 2, the time relationships are as follows: In .60 sec. after the pistol was fired the swimmer executed the crow-hop, which consumed .02 sec. In .35 sec. after the end of the crow-hop the swimmer left his mark. The total time consumed in executing the start was .97 sec.

By means of technique just described, the data were collected, and are presented.

THE DATA

Data were collected from ten varsity swimmers who had had experience in competition as members of the university team. Three of these men were of All-American selection, and three others placed in N.A.A.U. competition. A summary of the data is shown in Table I.

TABLE I
A SUMMARY OF THE MEAN STARTING TIMES OF TEN SWIMMERS HELD AS INDICATED

Sub. no.	Holding time in seconds						
	1.0	1.2	1.4	1.6	1.8	2.0	2.2
1	1.073	1.035	1.013	.998	.970	1.008	1.015
	.008	.010	.014	.014	.014	.012	.018
2	.980	.972	.979	.953	.960	.967	.980
	.009	.005	.005	.008	.004	.008	.003
3	.935	.907	.933	.910	.910	.935	.943
	.014	.009	.016	.016	.012	.019	.005
4	1.015	.977	1.053	.953	.990	.960	.962
	.017	.013	.014	.011	.020	.010	.012
5	.988	.993	1.013	1.015	1.017	1.005	1.035
	.009	.009	.010	.007	.008	.008	.007
6	1.070	1.052	1.040	1.025	1.060	1.010	1.040
	.012	.006	.008	.011	.015	.017	.017
7	1.038	1.020	1.033	1.028	1.012	1.003	1.022
	.008	.005	.008	.007	.006	.006	.017
8	1.015	1.027	1.030	1.018	1.015	1.008	.998
	.013	.010	.007	.014	.013	.009	.008
9	.950	.942	.935	.950	.922	.923	.885
	.011	.009	.007	.010	.006	.008	.011
10	1.000	.980	1.017	.968	.922	.925	.925
	.008	.009	.005	.013	.014	.020	.013
Mean	1.007	.991	1.003	.982	.978	.974	.981
S.D.	.041	.042	.040	.038	.047	.035	.049
P.E.	.009	.009	.009	.008	.010	.007	.010

An examination of the data in Table I reveals the fact that a holding time of 2 seconds yielded the fastest average starting time. It is evident that the holding time falls into two rather distinct groups, the dividing line running between 1.4 and 1.6 sec. The holding times of 1.0 and 1.4 seconds give approximately equal starting times, while the same is true of 1.6, 1.8, 2.0, and 2.2. An exception to the general trend occurs in the case of the holding time of 1.2 seconds. Although the mean starting time for the longer holding times in the upper bracket

is shorter than that recorded for 1.2 seconds, the differences are not significant. The significance of the differences for the various holding times is shown in Table II. Out of 21 comparisons made, in only 5 cases are there more than 90 chances in 100 that the difference is greater than zero.

TABLE II

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN VARIOUS MEAN HOLDING TIMES AS INDICATED

Holding time		O.D.	P.E. diff.	$\frac{\text{O.D.}}{\text{P.E. diff.}}$	Chances in 100 diff. is greater than o
1.0	1.2	.016	.013	1.23	80
1.0	1.4	.004	.012	.30	58
1.0	1.6	.025	.012	2.08	92
1.0	1.8	.029	.013	2.22	93
1.0	2.0	.032	.011	2.90	98
1.0	2.2	.026	.014	1.86	89
1.2	1.4	.012	.012	1.00	75
1.2	1.6	.009	.012	.75	69
1.2	1.8	.013	.014	.93	74
1.2	2.0	.016	.012	1.33	82
1.2	2.2	.010	.014	.72	68
1.4	1.6	.021	.012	1.75	88
1.4	1.8	.025	.013	1.92	90
1.4	2.0	.029	.011	2.64	96
1.4	2.2	.022	.013	1.69	87
1.6	1.8	.004	.013	.33	59
1.6	2.0	.007	.011	.64	67
1.6	2.2	.001	.013	.09	53
1.8	2.0	.003	.012	.25	57
1.8	2.2	.003	.014	.21	55
2.0	2.2	.006	.013	.46	62

In summarizing the results of this experiment, it is obvious that the longer holding time, 1.6, 2.2 sec., is preferable to the shorter holding time.

Among the group used in this investigation, three subjects used the crow-hop quite consistently, while the rest of them used it only occasionally. The following shows the mean time consumed by the group in executing the crow-hop:

Holding time in seconds	1.0	1.2	1.4	1.6	1.8	2.0	2.2
Crow-hops in seconds	.08	.08	.09	.09	.08	.09	.09

It is evident from the above data that the time consumed in the crow-hop is unrelated to the holding time. An investigation of the individual data shows that those who use this movement more or less consistently consume more time in executing the start than those who use it only occasionally. A further examination of the data shows that the swimmers who use the crow-hop are among the slower starters. This seems to indicate that, as far as starting times are concerned, the crow-hop is lost motion. Whether or not the added force makes up

for the lost time in getting started cannot be determined from this investigation. Since the mean difference between the starting time of those using the crow-hop quite consistently and that of those who employ it only occasionally is only .02 sec., one seems justified in concluding that the use of this movement is quite immaterial.

One of the problems in which there is general interest concerns the time consumed by a trained swimmer in executing the start. On the basis of the data collected in this investigation, disregarding holding time influence, the swimmer who is trained for competition consumes approximately 1 sec. (.988 sec.) in getting off his mark after the pistol is fired.

It is interesting to compare starting time in sprint racing with starting time in sprint swimming. The runner consumes about .3 sec.[4] in leaving his marks as compared with 1 second for the swimmer. Obviously, the swimming start is slow, due to the position assumed on the mark. Evidently the swimmer is at a disadvantage as compared to the runner because he assumes a modified upright position rather than a crouch. The development of velocity on the part of the swimmer requires a relatively long time. This would seem to explain why he requires a larger holding time for the best execution of his start.

SUMMARY AND CONCLUSIONS

Data were collected from ten varsity swimmers to discover the relation between the length of time which they were held on their mark, and the time which they consumed in executing their start. The holding times studied were 1.0 to 2.2 seconds, in steps of .2 sec. Twelve starts were taken at each holding time. On the basis of these data, the following conclusions are drawn:

1. On the basis of means, the optimum holding time for the swimming start was found to be 2. seconds. However, the data show that there is no significant difference between the starting time for holding times of 1.6, 1.8, 2.0 and 2.2 seconds.

2. The use of the crow-hop in the swimming start seems to be a matter of individual technique, being the exception rather than the rule among the group studied. On the average, the group who used this movement only occasionally started .02 second faster than those who employed it rather consistently.

3. The mean time actually consumed by the swimmers in executing the start after the pistol was fired was .988 sec. In general, the data indicated that a trained swimmer may be expected to consume approximately one second in executing his start.

This opportunity is taken to acknowledge the assistance of Harold Oaks and Theo. Boyett in collecting the data presented in these studies.

[4] A. D. Dickinson, "The Effect of Foot Spacing on Starting Time and Speed in Sprinting and Its Relationship between the Size of the Man and the Position of the Feet." SUPPL. TO THE RESEARCH QUARTERLY 5:1 (March 1934).

Liability in Athletics in Oregon

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THE purpose of this investigation was to find the liability of school officials with regard to athletic injuries, spectator injuries, and transportation injuries connected with the interscholastic athletic program in the State of Oregon.

Valuable information was found in the Oregon Code, law books for the State of Oregon, and in the Oregon School Law. Yearbooks, bulletins, and handbooks of various state high school athletic associations also served as sources of material.

This material was collected in two ways: (1) by a study of documentary sources, and (2) by interviewing athletic officials.

Concurrent with the completion of this study in July, 1938, came the adoption of the Oregon Plan of Protective Insurance for athletes by the Oregon State High School Athletic Association.

The present study found, in regard to athletic and spectator injuries in Oregon, that schools and school districts have invariably paid damages for such injuries in order to avoid court proceedings.

Athletic and spectator injuries are best cared for by liability insurance that every school district should be required to finance. School officials should take this precaution for their own protection and for the protection of their pupils. The need for liability insurance is quite plain to those who have watched hundreds of young athletes ruined year after year because of injuries received in athletic competition.

The average cost of the various protective plans against athletic injury is $1.00 per sport per boy in the ten states that now use this protection. These states are: Maine, Vermont, Connecticut, Rhode Island, New York, North Dakota, Minnesota, New Hampshire, Massachusetts, Wisconsin, and Oregon.

In the transportation of athletes by school bus to the site of the contest, in case of injury the school district is only liable for negligence. Most school busses, however, are protected by liability insurance.

In the transportation of athletes by private car, the owner of the car is liable for damages to occupants of the car, except when they are "guest" passengers. Athletes are not guest passengers when the school pays for their transportation. In order to transport athletes safely, schools should furnish transportation that is covered by liability insurance.

Recommendations for desirable legislation:

Abstract of a thesis submitted as a partial requirement for a Master of Arts degree, University of Washington, 1938.

1. Laws and taxation regarding these matters should be standardized by the United States Department of Education so that inequalities will cease.

2. Liability insurance for school districts should be required in order to cover athletic injuries, spectator injuries, and transportation injuries.

3. Legislation necessary to allow school districts to finance extra-curricular activities should be passed.

4. A course in the essentials of school law for every public school teacher is suggested.

5. Parent and school responsibility in regard to damage and liability should be fixed definitely by law.

BIBLIOGRAPHY

Bellinger and Cotton's Annotated Codes and Statutes of Oregon, Compiled and Annotated by C. D. Bellinger and W. W. Cotton. (San Francisco: Bancroft-Whitney Company, 1902).

Cubberley, Elwood P., *State School Administration.* (San Francisco: Houghton Mifflin Company, 1927).

Dawald, Lorenz, Merton, *Oregon Supreme Court Decision on School Problems.* (Master's Thesis, University of Washington, Seattle, 1935).

Farmers Automobile Inter-Insurance Exchange Manual. (New York: National Bureau of Casualty and Surety Underwriters, 1938).

General Laws of Oregon. (Salem, Oregon: Frank Baker, State Printer, 1887).

General Laws of Oregon 1923, Compiled by Cozer. (Salem, Oregon: State Printing Department, 1923).

Hill's Annotated Laws of Oregon, Compiled by Hill. (San Francisco: Bancroft-Whitney Company, 1892).

Koch, Harlan C., "School Athletics Are a Colossus," *School Review* (September, 1937).

Lee, V. C., *Public School Liability in the State of Washington.* (Master's Thesis, University of Washington, Seattle, 1931).

Lord's Oregon Laws, Vol. 1–3, Compiled by Lord and Montague. (Salem, Oregon: Willis Duniway, State Printer, 1910).

Lloyd, Frank S., George Deaver, and Floyd R. Eastwood, *Safety in Athletics—The Prevention and Treatment of Athletic Injuries.* (Philadelphia: W. B. Saunders Company, 1936).

Manual of Automobile Insurance-Rules and Rates. (New York: National Bureau of Casualty and Surety Underwriters, 1938).

New York State Public High School Athletic Association Bulletin, April, 1937.

New York State Public High School Athletic Association Year-Book, 1936–1937.

New York State Public High School Athletic Association Year-Book, 1937–1938.

North Dakota High School League Handbook. (Fargo) 1937–1938.

Oregon State High School Athletic Association Bulletin. (Portland) January, 1938.

Oregon State High School Athletic Association Bulletin. (Portland) April, 1938.

Oregon Code Annotated, Vol. 2, Compiled under the Supervision of the Supreme Court of Oregon. (Indianapolis, Indiana: Bobbs-Merrill Company, 1930).

Oregon Reports, Vols. 1–147. (San Francisco: Bancroft-Whitney Company, 1852–1935).

Oregon School Cases; Complete Record. (Baltimore: The Belvedere Press, Inc., 1925).

Oregon School Laws 1937, Issued by Rex Putman, Superintendent of Public Instruction. (Salem, Oregon: State Printing Department, 1937).

Pacific Reporter, Vols. 1–300. (St. Paul, Minnesota: West Publishing Company, 1852–1931).

Shepard's Oregon Citations, Constitutions, Code Laws, etc., Compiled by the Publishers' Editorial Staff. (New York: Frank Shepard Company, 1919 and 1928).

Thorpe, Francis Newton, *American Charters, Constitutions and Organic Laws 1492–1908 of the States, Territories and Colonies Now and Heretofore Forming the United States of America.* (Washington: Government Printing Office, 1909).

Trussler, Harry Raymond, *Essentials of School Law.* (Milwaukee: Bruce Publishing Company, 1927).

Weltzin, Joachim Frederick, *The Legal Authority of the American Public School as Developed by a Study of Liabilities to Damages.* (Grand Forks, North Dakota: The Mid-West Book Concern, 1931).

The Standardization and Use of Objective Type Information Tests in Team Game Activities

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EXAMINATIONS are almost as old as formal education. Through the years, the form in which they have appeared has shown comparatively little change. Innovations in education have occurred gradually, and over a considerable period of time. On the other hand, the type of measuring instruments used to evaluate the effects of the educative process has evolved at a much slower rate. It is apparent, even now, that there is a tremendous lag in examination methods when compared with developments in other aspects of education. It was Horace Mann who in 1895 first called attention to the insufficiency of examination methods. He proposed, as a substitute, a "new type" examination. Though the sort of test designated "new type" by Horace Mann is unlike that which we now so designate, the arguments which he set forth in support of his notion of the need for new means of evaluation are still valid. He argued for "new type" tests because, according to his point of view, they are impartial, just to the pupils, more thorough than the older forms of examination, prevent "officious interference" on the part of the teacher, determine beyond argument whether or not pupils have really been taught, eliminate all possibility of favoritism, and make it possible to appraise the ease or difficulty of an examination. The information tests to be discussed in this paper are an outgrowth of a similar point of view.

In understanding how these information tests came to be, let us examine the philosophical aspects of the problem. It is believed that there is a positive relationship between the concept of physical education held during a specific period of time and the tools of evaluation which are concurrently used. This is demonstrated in the anthropometry of physical culture, the strength tests of physical training, and the various functional (functional in its broadest sense) tests of physical education. Modern physical education, conceived to be a method of education which contributes to the growth and development of all the powers of the whole child, seems to require a broader type of accounting than that necessitated by the older physical training. Our broadened concept of physical education is an outgrowth of the development of

A paper presented before the Tests and Measurements Section, A.A.H.P.E.R., Atlanta, April, 1938.

the concept of biologic unity of the individual. We know that he learns all over, or reacts all over, rather than in compartmentalized areas of his being. It does not seem possible, then, *from an educational point of view,* that an individual can, for example, be a good baseball player if he must depend upon signals from the coach to tell him when to run and where to play the ball, and an umpire to rule on each play, even though he may be faultless in his execution of the skills of throwing, catching, and batting. It is granted that, in certain situations, there may be some reason for coaches and umpires. In contradistinction to such a point of view, however, the function of the teacher of physical education is to help students—who learn all over—to be self-active, or independent in their thinking and doing and, in addition to be able to meet and solve the problems with which they are confronted in physical education activities.

The present-day teacher of physical education is, therefore, because of an enlarged point of view with reference to the nature and function of physical education, concerned not only with the development of skills and techniques of activities, but also with the development of habits and attitudes, and the acquisition of information pertaining to the activities in which the individual participates. By the same token, evaluation of pupil achievement in physical education must include all aspects and objectives of the program. This means, then, that in addition to the tools required for measuring achievement of skills and techniques, there are also needed tools for evaluating attitudes developed, and the amount of information acquired through physical education experiences. It was out of such a concept that we began, in 1929, to develop objective means for measuring achievement in certain physical education activities. The information tests which we are to discuss represent one part of our attempt to make evaluation in physical education more *objective,* and so to circumvent the dilemma of subjectivity.

We hear repeatedly the argument that, inasmuch as physical education is not a promotion subject, there is no reason to utilize any portion of the all too meager amount of time devoted to in-school instruction in physical education in finding out, by measurement, what has happened to a student as a result of those experiences. This appears to be a faulty point of view, for pupils have been, and are, being marked or graded in physical education. Such marking, to be defensible and explainable, must have basis in fact. Objective evaluation of pupil achievement is required if personal bias is to be eliminated from the giving of grades. It is also desirable in order that teachers may know how well they have taught, in order to motivate both teacher and pupil toward increasingly meaningful physical education experiences, and in order that the learning situation may be accurately diagnosed and subsequent remedial measures applied.

In building information tests of physical education activities, we

found ourselves in virgin territory. The first job, therefore, was to circumscribe the area, or subject matter, to be covered by such tests. We chose to begin work with specific team games. The activities selected were soccer, volleyball, and playground baseball (now called softball). For guidance in the technique of test construction we turned to the procedure set forth by Russell in his book *Classroom Tests*. For the sake of clarity let us take soccer as the example to be used in this discussion.

A period of three school years were spent in building and standardizing the soccer tests. The first edition of the information test was composed of multiple choice, completion, and true-false types of test items. After working with the test, the multiple choice and completion types of items were eliminated. It was believed that these two kinds of items were inappropriate at the level at which the test was being standardized. In addition, it seemed desirable to make the marking and scoring of the test as simple as possible. We were of the opinion that this could *best* be accomplished by utilizing only one kind of test item. In its present form, therefore, the soccer information test consists of 100 true-false statements covering game situations and playing regulations. It can be found in the December, 1932, issue of the RESEARCH QUARTERLY. One class hour, 50 minutes in length, is required to give the test. A minute and one-half is sufficient time in which to correct and score one student's paper. The technique for giving and scoring the test is outlined at the conclusion of this article.

In building the soccer information test, the following procedure was employed:

1. A list of 100 statements was prepared, all in true form, covering the significant elements of the rules and maneuvers of soccer. An attempt was made to have these statements be a real sampling of the aforementioned elements of the game. In order to facilitate composition of the test, statements are written on cards, slips of paper, or on one side of a sheet of paper which is later torn into strips, and consecutively numbered. When all statements are written, the cards, or strips of paper, are shuffled, for chance, not facility of composition, must determine the trueness or falseness of a statement in the completed test. It is also important to avoid having a consistent thread running through the test, for if this be true there is the possibility that one statement may help to answer another. Shuffling the statements helps to circumvent this hazard.

2. On the basis of chance, the statements are rewritten true or false, and as they are rewritten their order in the completed test is also determined by chance. The problem, then, is the way in which the chance trueness or falseness of a statement and its order in the completed test are determined. We followed the procedure of shuffling the 100 true statements, then drawing from the pile at random, and of having the

even-numbered statements, as shown in the original true form, appear in the rewritten and completed test as *true* statements, and those having odd numbers in the original true form appear in the rewritten and completed test as *false* statements. Should two, or three, or even more, even-numbered statements be drawn, by chance, for the rewriting process, then in the completed test there might be two, or three, or even more, true statements following one another. The reverse might also be true, or, neither situation might prevail, as bias of the test builder is eliminated if the trueness or falseness of a statement and the order of its appearance in the completed test are determined according to chance. Theoretically, then, there are as many true as false items in the test, though practically this should not be quite the case, and for reasons which will shortly be apparent.

3. Statements are rewritten so that they are definitely true or false. They should be written in such form as will provoke real thinking. This demands more care than is ordinarily exercised in making such tests. Specific determiners like *always, usually, all, sometimes,* and *never* must be eliminated. Statements should be as brief as is consistent with their clarity. They must be written in positive form. This means the use of *not* and *no* will be avoided. Finally, absurd, trivial, or catchy statements must be rigidly eliminated for they have no place in an examination designed to test fairly what a pupil knows with reference to certain subject matter.

4. Recheck the completed test to see if catch questions have slipped into it—if so, eliminate them—and for the purpose of making as sure as is humanly possible that the test is fair rather than misleading.

5. Determine the form in which the test is to be given and scored. In order that a test meet the criterion of objectivity, directions for giving and scoring it must be standardized. The standard directions used in administering the information tests are appended to this article. Tests were mimeographed and each pupil given a copy. The test booklet asked for certain pertinent information about the pupil taking the test, informed him as to the purpose of the test, the way in which he was to proceed in taking it, and a fore exercise to make clear the way in which statements were to be marked.

The soccer information test, as were all others, was scored "rights" minus "wrongs." This formula for scoring was used for the following reasons. A good true-false test will contain *approximately* the same number of true items as false items. This is evident because of the way in which trueness or falseness of the various items which compose the test is determined. Therefore, it is inherent in the technique for constructing a true-false test that it is possible for a pupil who knows nothing of the subject to go through the test and get about half of the statements correct. By rewriting a *few* more statements true than false, or vice-versa, and by using the rights minus wrongs formula for scoring

the test, this dilemma is obviated, for such a score would be zero, or near it. In contradistinction, if the number of statements answered correctly were the score, such an individual would get a score to which he is really not entitled. In its final form the soccer information is scored rights minus wrongs. The raw scores are T-scaled. A perforated tagboard scoring key speeded up and made more accurate the correction of the test papers.

May I digress briefly at this point to call your attention to the fact that Briggs and Armacost [1] have shown that a true-false test can satisfactorily be given orally to older groups?

6. Give the test a preliminary try-out, and then analyze the results to see wherein it could be improved and in order to get the facts of the learning situation. The first point in the analysis is to make a distribution of the test scores. Then study the form which the distribution of scores takes. If the group being tested is representative of the total population of which it is a part, the form of the curve will indicate whether or not all ranges of ability are equally well tested and whether or not the test was too easy or too difficult. The second point in the analysis is to determine the degree of difficulty of the individual test items. In order to test all ranges of ability equally well, every item should be equally more or less difficult than every other item. In other words, there must be no gaps in degree of difficulty of the questions. For example, one statement should not be exceedingly more difficult than all the other statements, or one statement very much easier than the others, but rather the second most difficult statement should vary in difficulty from the most difficult statement by an amount equal to that by which the third most difficult statement varies from the second most difficult statement, and so on. Should gaps exist in the degree of difficulty of the various questions, we have a situation akin to that which would be found in measuring with a yardstick composed of inches of different lengths. Where notable gaps exist, the only remedy for the situation is to remake the test. Degree of difficulty can be determined by tallying the number of times each statement is missed. If this tally is then rearranged in graphic form—most difficult statement at the right and least difficult at the left—a clearer picture of the test is obtained than that gained simply by tallying the number of times each statement is missed. Such a graph will also help to give an estimate of the magnitude of the gaps which may or may not exist in question difficulty. When questions are arranged in order of difficulty, the graphic form of a good test will conform to stair steps.

As has already been said, a period of three school years was required before the soccer information test seemed to conform to the criteria of objectivity, reliability, and validity, which are necessary for a standardized test. The yearly revisions were based upon the reliabil-

[1] "Results of an Oral True-False Test," *Jl. Ed. Research*, 26 (April 1933), 595.

ity of the test as shown by correlating the scores on chance halves of the test and upon an analysis of the form of the distribution of scores on the test and the degree of difficulty of the test items. The criterion of objectivity was satisfied by the type of the test itself, and in having standard directions for giving and scoring it. No reliable criterion was available for determining the reliability of the information test, other than the test itself. Accordingly, scores on chance halves of the test were correlated and the reliability, determined by Spearman's formula, was shown to be $+ .903 \pm .02$. Lacking a tenable anchor by which to demonstrate validity, the soccer information test was assumed to be valid on the bases of choice of material suitable for the test, and a significant increase in accomplishment at successive age levels.

The situation which led to the establishment of these tests has already been described. The extent, however, to which these tools fulfilled the function for which they were built is not known. Empirically it can be said that they have proven of tremendous practical value as teaching tools. Marks can be given basis in fact. Their use has also helped to demonstrate that the physical education period should be an instructional period, rather than a play period, that achievement in physical education is really many-sided in that it involves skills, information, habits, and attitudes. Finally, they have been valuable for the reason that when one assumes the burden of setting up a program and of defining objectives to be achieved, the exigencies of the situation demand that there be actual knowledge of the extent to which those objectives are attained.

Out of our use of information tests, there come, however, certain questions. Does the low, though positive, correlation between scores on the soccer skill test and scores on the soccer information test indicate spotty teaching—that is, is an undue amount of attention given to the development of skills and little or no attention to the acquisition of information, etc., or does it indicate a real lack of relationship between achieved skill and information acquired? Are all the objectives of physical education equally well achieved? Should they be? Perhaps these are problems for future study.

DIRECTIONS FOR GIVING AND SCORING INFORMATION TESTS

I. *Administering the Test.*—

1. Make sure that pupils are arranged comfortably for work and that all are provided with pencil or pen.

2. Before giving out the test, ask for questions so as to clear up any points about which there may be confusion in the minds of the students.

3. Pass out the papers *face down*. Direct pupils to leave them this way.

4. When each pupil has his test booklet, say: "Turn over the paper and fill in the information asked for at the top of the page. When you have finished this, wait quietly for the next instructions."

Gauge the amount of time necessary to do this by watching the group. Encourage them to make no waste movements.

5. Read the introduction to the test as given on each pupil's paper in order to make sure pupils know exactly how to proceed. Read the fore exercise and note how it is marked.

6. Give the signal to go to work.

7. Stop pupils at the end of 50 minutes and collect the papers.

II. *Scoring the Test.*—

1. Go down the first page of the test and draw a straight line through the T and F of any statement omitted. Count as you go, then record this number at the bottom of the page.

2. Take the key for the first page and place it so that the number of the statement at the top of the page and at the bottom of the page is exposed.

3. When the key is in position, the correct answers are seen through the openings in the key.

4. Draw a line through the T or F of any statement not so circled as seen through the openings in the key, counting as you do the number of statements missed.

5. At the top of the succeeding page write the number of statements missed to that point.

6. Glancing at the number at the bottom of the previous sheet, successively count and mark out the statements omitted on the following sheet and record that number at the bottom of the page.

7. Place the key for the succeeding page in position, note the number of statements missed to that point, draw a line through the T or F of any statement not so circled as seen through the openings in the key, and counting successively as you go.

8. Repeat this process for each page of the test. Watch to make sure that you use the key appropriate for each page of the test. Correcting papers in this manner means that you will have at the bottom of each page the number of statements omitted to that point in the test, and at the top of each page the number of statements missed to that point in the test.

9. As the last page is corrected, place the number of statements omitted under the number of the last statement in the test, and subtract. From this number take twice the number of statements missed. The last figure, then, is the individual's score on the test. Record it on the first page of the test booklet. Note the following illustration of the application of the formula rights minus wrongs equals the score:

100 statements on the test	14 statements missed
— 24 statements omitted	
86 statements attempted	
— 28 twice the number of statements missed	
58 score on the test	

III. *Converting the Raw Score into Letter Grades.*—

1. Make a frequency distribution of the scores.

2. On the basis of practice in your school with reference to the proportion of the group receiving A, B, C, D, or E, convert scores into letter grades.

Where no definite practice exists:

a) Calculate the standard deviation of the distribution.

b) Divide the range of six standard deviations into five equal parts (in order to divide the distribution into five classes, A, B, C, D, and E). Each letter grade will be represented by ⅚ of one standard deviation.

Grade A over +1.8 σ above the mean
B +.6 σ above the mean to +1.8 σ above the mean
C —.6 σ below the mean to +.6 σ above the mean
D —.6 σ below the mean to —1.8 σ below the mean
E lower than —1.8 σ below the mean

RODGERS-HEATH PLAYGROUND BASEBALL INFORMATION TEST

NAME..... AGE.... GRADE.... DATE.....
Last First
SCHOOL..... 100—.....—.....—.....=.....
omitted right wrong score

This is a test to show what you have learned from your study of playground baseball. It is not expected that you can answer every statement.

The letters T and F have been placed before each statement given below. Draw a circle around the letter T if the statement is TRUE. Draw a circle around the letter F if the statement is FALSE or partially false. DO NOT GUESS. If you come to a statement you can't answer, skip it and go on. DO NOT GUESS. You will be penalized for each statement marked incorrectly by taking one point or credit from the number of statements marked correctly.

Examples are given below. Read them carefully and then proceed to answer the others in like manner.

T F There are ten players on a playground baseball team.
T F A regulation hard baseball is used in playing this game.

T F 1. A strike is called on the batter when a legally delivered ball passes over home plate between the batter's shoulders and knees and is not struck at.
T F 2. A base runner is safe, if, in sliding to a base, he move or dislodge it.
T F 3. It is better to encourage a player who has made a poor play than to fuss at him.
T F 4. As soon as the pitcher winds up to deliver the ball the runner may leave his base.
T F 5. The term "passed ball" is applied when the catcher lets a ball get by him, a batter being in the box.
T F 6. A base runner may take one base on a passed ball.
T F 7. The pitcher throws a ball which strikes the ground before passing home plate. The batter starts to swing at the ball but checks himself before completing his swing. Ball bounds up hitting his bat and rolls into foul territory. Umpire calls "Foul ball."
T F 8. A block ball is a grounder stopped by a shortstop.
T F 9. It is a good plan to argue with the umpire if you think he has made a wrong decision.
T F 10. A ball well thrown is faster than a ball thrown poorly.
T F 11. In batting scoop the ball with the bat.
T F 12. A force play occurs when a player causes another player to move from one base to another.
T F 13. The batter should move to the back of the box in batting against speedy pitching.
T F 14. The batter is out on an illegally batted ball.
T F 15. The batsman is out if he intentionally kicks or interferes with a ball he has just hit.
T F 16. The batsman is in his box in position to bat. Pitcher delivers the ball. Batsman seeing the ball would hit him tries to dodge it. Ball hits the batsman's bat while the bat is over his shoulder. Ball goes fair. It is counted neither a ball nor a strike.

T F 17. The batter stands the length of his bat away from the plate.
T F 18. A base runner leaving his base on a pitched ball before it has reached or passed home plate shall be called out.
T F 19. A runner may slide to first base.
T F 20. The fielder stands on fair territory and in fielding a fair hit ball fumbles it so that it goes into foul territory. The umpire calls it a fair ball.
T F 21. The strong batter is less able to hit slow balls than the weak batter.
T F 22. If the pitcher drops the ball in the act of delivery it is called "block ball."
T F 23. In catching fly balls above the waist the player should cup his hands, little fingers together, fingers pointing downward.
T F 24. In batting the bat should be swung in a horizontal plane.
T F 25. A batted ball which hits the umpire before being handled by a fielder is not in play and base runners may not advance.
T F 26. A batted ball which hits third base and bounds into foul territory is a foul.
T F 27. The runner is out if first baseman holds the ball on first base before he gets there.
T F 28. A runner is on second base, the batter makes a fair hit. A force play follows.
T F 29. Runners are on first and third bases. The batter hits the ball over the right fielder's head. The runner from first must be touched out.
T F 30. Players in the field are required, by rule, to occupy exact positions.
T F 31. If a batter has one strike and two balls when the third out is made he is the first batter up in the following inning.
T F 32. A base runner may leave his base as soon as a batted ball touches the hands of a fielder and he cannot be doubled out.
T F 33. The pitcher may give a snap or jerk to the ball as he delivers it to the batter.
T F 34. A right-handed batter grasps the bat left hand on top of the right.
T F 35. A pitched ball which hits the batter is called a dead ball.
T F 36. A block ball is one handled by a person not engaged in the game.
T F 37. The base runner is out if he interferes with a legally thrown ball.
T F 38. A right-handed pitcher steps forward with his left foot as he throws the ball.
T F 39. Runners are on first and third. The batter makes a fair hit. A force play occurs.
T F 40. Right shortstop determines his position as he stands at pitcher's box, facing home.
T F 41. The batter finds his distance from the plate by grasping the bat and then tapping the center of home plate with his bat.
T F 42. Left shortstop should always back up plays to first and second base.
T F 43. Basemen should "meet the runner" with the ball.
T F 44. An illegally batted ball is one which settles on foul territory.
T F 45. Base runners may advance one base if the pitcher drops the ball in the act of delivery.
T F 46. In catching fly balls which go over the head, fielders should back up.
T F 47. The batter should be ready to hit every pitched ball.
T F 48. The only players required to occupy exact positions are the pitcher and catcher.
T F 49. A fielder on foul territory fumbles a ball which goes into fair territory. The umpire rules "Fair ball."
T F 50. A time at bat is credited the batter if he is at bat when the third out is made.

T F 51. If there are less than two outs play to get the advance runner out.
T F 52. The batter should run only when he sees that he has hit a fair ball.
T F 53. The captain may question an umpire's interpretation of a rule but never his judgment of a play.
T F 54. In catching fly balls below the waist the player should cup the hands, little fingers together, fingers pointing downward.
T F 55. A dead ball is called neither a ball nor a strike.
T F 56. A base runner should keep his base on a caught fly ball.
T F 57. As the batter stands at the plate three-fourths of his back should be toward the pitcher.
T F 58. Batter shall be called out if he intentionally gets in the way of a pitched ball.
T F 59. If the ball is always started from the same position, thrown with the same speed, turned loose at the same point, the stride not varied, it will always strike the same mark.
T F 60. The aim of all batters is to swing at balls high over the plate.
T F 61. A right-handed batter grasps the bat right hand on top of left.
T F 62. Base runners may advance one base on an illegally batted ball.
T F 63. A base runner may have a substitute if he so desires.
T F 64. Base runners hold their bases on a blocked ball.
T F 65. A batter has two strikes and bunts the next ball. It is a safe hit.
T F 66. When the team in bat has two outs, players in the field should make the easy out.
T F 67. A ball is determined fair or foul by where it strikes in the infield and where it rolls in the outfield.
T F 68. A pitched ball which hits the batter is called a "dead ball."
T F 69. The pitcher, while out of his box, may feint a throw to a base without a balk being called.
T F 70. A base runner must not leave his base while the pitcher, standing in his box, holds the ball, or before it has reached or passed home plate.
T F 71. The pitcher should leave infield hits to the infielders, unless hit directly to him.
T F 72. One base is allowed on an overthrow to second base.
T F 73. The bat should be held with the trade mark up.
T F 74. Runners may advance one base without liability to be put out on an overthrow at first, third, or home.
T F 75. If the pitcher delivers an illegally pitched ball he shall be removed from the game.
T F 76. A dead ball shall be called a ball.
T F 77. To make a legal pitch the pitcher must begin his delivery with both feet on the plate, take only one step forward, and keep one foot in contact with the plate until after the ball is delivered.
T F 78. The umpire calls "dead ball" and the runner shall be sent back to his base if he be hit by a batted ball before such ball is touched by a fielder.
T F 79. A fielder, on foul territory, fumbles a ball which goes into fair territory. The umpire rules a foul ball.
T F 80. The batter should run out every hit.
T F 81. The pitcher should field all balls hit between first and second base.
T F 82. The catcher should always make a target for the pitcher to throw at.
T F 83. The batsman is out on a caught foul tip on the third strike.
T F 84. Batters attempting to bunt are called out.
T F 85. A batted ball hits first base and bounds to the outfield in foul territory. It is a fair hit.

T F 86. If the batsman strikes at an illegally delivered ball it shall not be counted a strike.
T F 87. Should an inning close when a batter has had two balls and one strike, he is considered as having had a time at bat.
T F 88. "Block ball" is called if a batted ball hits the umpire and base runners may not advance.
T F 89. An illegally batted ball is one batted by the batsman standing with one or both feet out of the batter's box.
T F 90. Base runners are allowed to take a lead off base.
T F 91. A team should forfeit the game if the "first string" men cannot play.
T F 92. Batter is out on a caught foul tip on his second strike.
T F 93. A runner from third base may score only on a play or hit.
T F 94. Swinging at balls too high over the plate is a common fault in batting.
T F 95. The base runner is out if he be hit by a fair batted ball before such ball is touched by a fielder.
T F 96. A ball is determined fair or foul by where it rolls in the infield and where it strikes in the outfield.
T F 97. Fielders and shortstops should back up the basemen.
T F 98. A base runner who runs the bases in reverse order may be put out by touching him with the ball or by a baseman holding the ball on the base to which he is entitled.
T F 99. Basemen should tag with the runner in making a put out at a base.
T F 100. The batter's box is on foul territory.

Library Research that Works

By Wesley P. Cushman

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PHYSICAL educators, to be most effective in their teachings, must be aware of new studies that may enable them to improve their methods and curricula. They should not confine themselves to those studies conducted in their own field, but should also search for pertinent findings in other fields, such as general education, physiology, psychology, recreation, and sociology. To locate such studies the physical educator needs a working knowledge of the techniques of library research.

This article presents a general plan for using the library in such work as preparing papers, theses, lectures, and courses of study. The plan has been tested with satisfactory results. The general method should be helpful to others in physical education who need to use library materials.

The plan includes six steps, which will be discussed in the following order: (1) the working outline; (2) tentative headings for reference; (3) sources and library indexes; (4) the tentative bibliography; (5) reading and note-taking; (6) organization of notes and complete write-up.

1. *The Working Outline.*—Make a working outline before visiting the library. Fifteen minutes of profitable planning here may save hours later. The types of questions you need to ask yourself in this step will be made clearer from a specific illustration. Here is a problem: To what extent should the college program of physical education for non-majors be required or elective? Sometimes the first thing to do is to define terms, something that is hardly necessary here. Next it is obviously helpful to think of subtopics or contributing problems such as: Should the requirement in physical education follow the institution's policy on requirements in general? What requirements will be made for individual students? Will the varsity athlete be excused from regular physical education classes? How will requirements for the individual be determined—by health examinations and achievement tests? What are the arguments for and against requirements? Such questions should be written down before you consider what library materials are needed to solve the problem.

Now you are ready to enter the library.

2. *Tentative Headings for Reference Sources.*—Wherever your desired references are, they will be listed by the library indexes and

catalogs under appropriate headings. It is advisable to list several possible headings. The illustrative problem at once suggests the headings of "Physical Education" and "Curriculum," with the subheadings of "Colleges and Universities" or "Higher Education." Other headings may be found by glancing through Voegelein's *List of Educational Subject Headings*,[1] the card catalog of your library, or the index section of Sefton's *Guide to the Literature of Physical Education with Aspects of Health Education*.[2]

3. *Sources and Library Indexes.*—With your tentative list of subject headings, you are now ready to seek the sources and indexes for the best references on your problem. Sefton's *Guide*, cited above, directs you to the most likely indexes, bibliographies, and similar sources in the field of physical education. The Education Index is very valuable. This index, beginning in 1929 and kept up to the last month or two, lists most of the textbooks, periodical articles, bulletins, reports, and special publications of interest to physical educators. The main heading of "Physical Education" (with subheadings) is used by the Index. For our illustrative problem, you find under the subheading "College," "Resolved That Physical Education Should Be Put on an Elective Basis with Credit on the Same Conditions as for Other Subjects in the Curriculum,"—A Debate. H. E. Lowe and Others (In *College Physical Education Association Proceedings*, 1935, p. 65–74). Other articles and textbooks on administration in colleges are also to be found that will aid you in solving the problem.

You must know, of course, how to use the card catalog in your library. A pamphlet explaining how to locate materials may be available. If not, the librarian will be pleased to furnish you with the necessary information. Remember that such a catalog covers only the books and separate publications the library owns and has catalogued. It will not list books purchased but uncatalogued, it will be incomplete if the library has been short on purchases, and it will not cover periodical references.

4. *The Tentative Bibliography.*—From your best sources, select those references by title which seem most promising for your problem. Select all of the references for use on particular units or subtopics in your working outline before copying. Selection requires careful thought, and the task of copying may prove distracting. Copy your references from a particular index, however, before proceeding to another. Work from recent indexes to older ones, because recent ones frequently cite back references.

Copy each reference on a separate bibliography card. The writer

[1] L. B. Voegelein, *List of Educational Subject Headings*, (Columbus, Ohio: The Ohio State University Press, 1928).

[2] RESEARCH QUARTERLY, 6 (December 1935) 3–47.

has found the Alexander Universal Bibliography Card [8] most valuable here. At this time copy only the data given in your index. Any additional bibliographic data needed on a reference may be secured when you know that this reference is to be included in your final bibliography.

Full data are necessary if your final bibliography is to be published in order that the reader may locate the reference in the library or purchase it himself if he desires. You should use an accepted form for citing your full bibliographic data. Style manuals are available for this purpose. Select the form used by your publisher. If you are not publishing, choose the one you like best and stick to it. As an example, let us take the Education Index. It gives only the title, publisher, date of publication, first and last name (or initials and last name) of the author of the book or article. For your final bibliography the article cited above may be in a form similar to this: Lowe, H. E., *et al.*, "Resolved, That Physical Education Should Be Put on an Elective Basis with Credit on the Same Conditions as for Other Subjects in the Curriculum," *The College Physical Education Association Proceedings* (December 1935) 65–74.

5. *Reading and Note-Taking.*—You will recall that your bibliography of references was selected by title only. It is a great waste of time to read carefully through each reference, take notes, and then go on to the next. Many references will not prove so valuable as you first thought. Skim a reference and take notes on those parts that are pertinent.

For a *book,* skim by using its guide-posts: Title page for reputation of author and publisher, preface and foreword for scope and purpose, table of contents and index for specific parts that may relate to your problem. For an *article,* some of the guide-posts that help you judge a book are missing. However, the position of the author and the type and reputation of the magazine or organization publishing the article assist you in your judgment of the worth of the article. In judging the article selected for the illustration you find the authors hold positions in noteworthy institutions. Furthermore, the College Physical Education Association would not select incompetent men to debate at their meetings an issue of such importance. Therefore you conclude that here is something for careful reading. You read and take the necessary notes before proceeding to your next reference. Keep your purpose in mind so that your interests do not sidetrack you from the problem at hand. Proceed in the same manner through each of your other references. Such intelligent skimming and reading save hours of useless labor.

In note-taking, use separate cards the same size as your bibliogra-

[8] Carter Alexander, *Alexander Universal Bibliography Card.* (New York: Bureau of Publications, Teachers College, Columbia University, c1934). In packages of 100, 65c.

phy card, writing on one side only. Such cards may be used to note exact quotations, uses for parts of references, what is in the reference, ideas not quoted exactly, facts and brief statistics, criticisms, and dates covered by data. Make citations to your bibliography cards so that you may trace your notes to their source. A good note will contain what was said or written about the topic; it is definite with no doubt as to meaning; it has all the data necessary to locate it; and it is made with the idea that it is to pass through the mind before it is incorporated in the final product.

6. *Organization of Notes and Complete Write-Up.*—Notes are valuable only when they are properly organized. In organization you may use a letter-number system, lettering the sections and numbering and lettering the notes to show succession or subdivision, I, A, 1, a, etc. At first you may file them under headings and subheadings of your working outline, but as your notes grow in number, keep your headings on a separate paper and file your notes by it in the letter-number method. This loose-leaf system allows for expansion anywhere, for you can insert additional notes (cards) in appropriate sections by using the same numbers or reference signs.

With your notes so organized you are ready to make whatever write-up may be desired. The write-up, however, is another story.

This plan of library research has been successfully used by the writer in his graduate and research work for the last few years. At first the plan required considerable care and thought. Now, however, use of it has become easy through practice and habit. As compared with any procedures in using library materials previously employed by the writer, it has one great merit: *it works.*

A Survey of Special Interest Activities

By Roy J. McMurray
Supervisor of Physical Education
Saginaw, Michigan

IN CONNECTION with the local Council of Social Agencies of the City of Saginaw, a survey of the likes and dislikes of 10,000 school children was conducted in May, 1938. The method followed was that of a survey technique, using a questionnaire. The survey compiled information at three age levels, showing likes and dislikes, and desire for participation at each of these levels. The questionnaire was administered by each homeroom teacher, and the results of each classroom were tabulated by the homeroom teacher. The copies of the questionnaires were then returned to the office of the superintendent for final compilation, and are still on file for further study by any of the social agencies.

The questionnaire contained eighty-four questions. The questions were not too personal and were asked only with the idea that the answers received would improve the program. Each boy and girl filled out his or her report with the aid of instruction given by the homeroom teacher.

In knowing the likes and dislikes of the 10,000 children of Saginaw, it was felt that a much broader program in recreation might be offered. Many school children have special interests in activities that are difficult to offer in the school program, yet these activities may be promoted by other agencies within a community, and by so doing the entire community recreation program would be enhanced. It was with this thought in mind that we determined to carry out this study.

A point of special interest well worth pointing out before looking into the statistical findings is that in the semi-school organizations there is a decrease in percentage of participation as one goes up the scale from elementary to senior high school.

Note first the results of participation by boys and girls in semi-school organizations. A decrease in membership percentage is noted as we go up the scale from elementary to senior high school.

SEMISCHOOL ORGANIZATIONS

Y.M.C.A.	Boy Scouts	Cub Packs
Safety Patrols	Hi-Y	Boy Town League
Brownies	Campfire	Girl Scouts
Y.W.C.A.	Blue Birds	Girl Reserves
Church Clubs		Other Clubs

2,113 or 69 per cent of the 3,002 elementary boys and girls, grades 4, 5, and 6, who were surveyed belong to one or more of the above listed organizations.

2,370 or 67 per cent of the 3,511 junior high school boys and girls, in grades 7, 8, and 9, who were surveyed, belong to one or more of the above listed organizations.

1,405 or 62 per cent of the 2,254 senior high school boys and girls, in grades 10, 11, 12, who were surveyed, belong to one or more of the above listed organizations.

	Grades 4, 5, 6		Grades 7, 8, 9		Grades 10, 11, 12	
	No.	Per cent	No.	Per cent	No.	Per cent
Total surveyed	3022	100	3511	100	2254	100
Summer Activities						
With family on vacation	1689	55	1706	49	1007	45
Stayed at home	1931	64	2187	62	1665	74
Went to camp	296	10	474	13	311	14
Would like to go to camp	2711	90	3046	87	1901	84

Observe how the child grows away from the family as he becomes older. High school pupils begin to plan their summer activities for themselves, and the desire for camp is not being satisfied.

Religious Activities						
Attend Sunday school regularly	2139	71	1908	54	828	37
Attend church regularly	1812	60	2345	67	1660	74

Note the decrease as the child grows older in Sunday school attendance, and the increase in church attendance, which seems to be a very natural change.

Hobbies						
Have some hobby	1954	65	2251	64	1399	62
Drive cars	43	1.5	626	18	1105	49
Ride bicycles	2032	67	2688	77	1621	72
Own bicycles	949	31	1694	48	992	44
Read newspapers daily	2321	77	3088	86	1990	88
Use library regularly	2107	70	2845	81	1625	72
Take Part in Athletics						
In schools	2172	72	1775	51	751	33
In churches	573	19	553	16	370	16
Other groups	1426	47	1777	51	788	35
Know how to swim	1406	47	2083	59	1497	66

The boys and girls of junior high school age are the bicyclists, while the senior high school people are becoming "car conscious."

Winter Sports						
Like winter sports	2821	93	3170	90	1817	81
Do ice skate	1833	61	2452	70	1648	73
Do roller skate	2531	84	2741	78	1562	69
Money to Spend						
Have monthly allowances	1472	49	1515	43	1022	45
Earn some money	2294	76	2450	70	1362	60
Like Music						
Like to sing	2441	81	2171	62	1260	56
Sing outside of school	811	27	720	20	415	18
Play instruments	1055	33	1275	36	771	34
Play in band (school)	57	2	394	11	173	7.5
Play in school orchestra	38	1.5	278	8	158	7

Note the decrease as the age rises. In singing, possibly as they grow older they have found out that they *cannot* sing.

ART						
Soap or wood carving.....	2245	74	1582	45	514	23
Model in clay	2546	84	1429	41	399	17
Paint pictures	2394	79	1607	46	525	23
Draw pictures	2638	87	1898	54	800	35

The boys and girls like to draw and paint pictures, but note the larger percentage who prefer to draw than to paint. Perhaps the amount of skill necessary accounts for this. Note, also, that interest seems to decrease as the age level rises.

These are only a few of the comparative interests of boys and girls, but through this information it is clear that the same program does not fit all age levels, and the information also helps to show weaknesses in reaching the desires of boys and girls.

A Study of the Most Popular Games of Low Organization—Grades I-VI

By George C. Ekdahl
Director of Physical Education
Lincoln School, Highland Park, Illinois

INTRODUCTION

ONE of the pressing problems which appears to confront the average elementary school teacher in physical education is that related to choosing games for the various grades of the school.

There is an abundance of literature available to teachers dealing with games of all types; however, except in the courses of study, little attempt has been made to allocate these games to the different grades of the elementary school.

It was decided to make a survey of present practice regarding the teaching of games in the various grades of the elementary school of the country for the purpose of determining those games which were found to be most popular with the children of the respective grades. With this in mind, forty-two directors of physical education, serving in as many cities in the United States having a population of 200,000 or over, were asked to cooperate in securing the information desired.

Twenty-five of these directors, in twenty-five different cities, gave assurance that they were interested in the study, and would aid in the investigation. These directors were sent materials to be used by the teachers in their school systems, upon which the latter were to name and describe the four most popular games of low organization played by the pupils in each of the six grades of their school.

Eight hundred and seventeen teachers returned the materials in question, giving what might be considered a rather comprehensive group of data.

The games named by these teachers as most popular for each grade were rated according to frequency of tabulation. The ten ranking games in each grade were chosen for description. The results of this procedure are discussed below.

DISCUSSION OF THE FINDINGS

First Grade.—Table I shows the ten most popular games ranked according to the frequency with which they were named. It is indicated that the first three games are very popular in this grade. Cat and Rat is the popular choice by more than a two-to-one vote. Farmer in the Dell, although classified under rhythmical activities, is given strong support as a first-grade game, and therefore is given consideration in this study.

TABLE I

POPULAR GAMES OF THE FIRST GRADE

1. Cat and Rat	139	6. Hill Dill	20
2. Squirrels in Trees	59	7. Come Along	18
3. The Farmer in the Dell	55	8. Squirrel and Nut	16
4. Brownies and Fairies	28	9. Bird Catcher	15
5. Jump the Brook	23	10. Run for Your Supper	15

Second Grade.—Table II shows the ten most popular games ranked according to the frequency with which they were named. It is apparent by this study that games played in a respective grade are often enjoyed in the grade level above and below to a great extent. Table II indicates that Cat and Rat is losing popularity, but still maintains first position. Four new games have been elected to places amongst the first ten for second grade, and are in second, fourth, eighth, and tenth positions respectively; six games were carried over from first grade.

TABLE II

POPULAR GAMES OF THE SECOND GRADE

1. Cat and Rat	80	6. Bird Catcher	25
2. Midnight	55	7. Brownies and Fairies	24
3. Squirrels in Trees	37	8. Three Deep	22
4. Dodgeball	36	9. Hill Dill	16
5. Farmer in the Dell	26	10. Black Tom	15

Third Grade.—Table III shows the ten most popular games ranked according to the frequency with which they were named. Dodgeball is nearly twice as popular as any other game at this grade level. It is obvious that the popular first and second grade games are rapidly being replaced. Six new games are amongst the elected ten for the third grade. There are four games carried over from second grade.

TABLE III

POPULAR GAMES OF THE THIRD GRADE

1. Dodgeball	101	6. Red Light	20
2. Three Deep	55	7. Squirrels in Trees	19
3. Cat and Rat	35	8. Kickball	19
4. Center Base	25	9. Black and White	18
5. Slap Jack	20	10. Fire on the Mountains	18

Fourth Grade.—Table IV shows the ten most popular games ranked according to the frequency with which they were named. Dodgeball has increased in popularity over its preceding tabulation in Table III. Three Deep is holding its second place position; Cat and Rat rated thirteenth in this tabulation, which is too low for consideration at this grade level. Six new games have been elected to this grade and four games have held over. Table III shows Kickball and Black and White in eighth and ninth positions respectively. In the table below they are tied.

TABLE IV

POPULAR GAMES OF THE FOURTH GRADE

1. Dodgeball	159	6. Jump the Shot	27
2. Three Deep	48	7. Pom-Pom-Pull-Away	22
3. Club Snatch	32	8. Newcomb	21
4. Black and White	28	9. Poison	20
5. Kickball	28	10. German Batball	19

Fifth Grade (Girls).—Table V shows the ten most popular games ranked according to the frequency of tabulation. Dodgeball unquestionably reached its peak in the fourth grade level, but also continues in first place in the fifth grade. Club Snatch and Three Deep have changed places over the preceding grade. Kickball is indisputable in fourth place, while Black and White dropped to sixth place. A variation of Dodgeball is now in eighth position, the only new game over Table IV.

TABLE V

POPULAR GAMES OF THE FIFTH GRADE (Girls)

1. Dodgeball	135	6. Black and White	25
2. Club Snatch	53	7. Jump the Shot	20
3. Three Deep	45	8. Progressive Dodgeball	13
4. Kickball	30	9. Poison	12
5. German Batball	27	10. Newcomb	12

Fifth Grade (Boys).—Table VI shows the ten most popular games ranked according to the frequency with which they were named. Dodgeball is the predominating favorite with Club Snatch remaining in second place. Kickball has steadily increased in popularity, having progressed from eighth place in Table III to third position in the table above. Black and White appears to be a girls' game; dropping from sixth position in Table V (Girls) to ninth in the table above. Conversely, the above tabulations show Kickball to rank higher than in Table V (Girls). Three new games are introduced at this grade level and are in fourth, seventh, and eighth places.

TABLE VI

POPULAR GAMES OF THE FIFTH GRADE (Boys)

1. Dodgeball	149	6. German Batball	21
2. Club Snatch	47	7. Spud	18
3. Kickball	34	8. Prisoner's Base	18
4. Bombardment	28	9. Black and White	17
5. Three Deep	27	10. Poison	12

Sixth Grade (Girls).—Table VII shows the ten most popular games ranked according to the frequency with which they were named. Dodgeball dropped eight votes in popularity in comparison with its number in Table V. Black and White apparently is losing interest; Kickball rose to second place from fourth place as shown in Table V. Bombard-

ment and Endball are new games for the sixth grade level for girls, otherwise the table remains the same as Table V.

TABLE VII

POPULAR GAMES OF THE SIXTH GRADE (Girls)

1. Dodgeball	128	6. Jump the Shot	19
2. Kickball	43	7. German Batball	17
3. Club Snatch	35	8. Black and White	17
4. Three Deep	29	9. Newcomb	14
5. Bombardment	20	10. Endball	13

Sixth Grade (Boys).—Table VIII shows the ten most popular games ranked according to the frequency with which they were named. Table VI (Boys) listed Club Snatch in second position. In the table below it has dropped to fourth place. The sixth-grade boys substituted Pom-Pom-Pull-Away in fifth position for Three Deep that rated in the same position in Table VI. Endball is enjoyed to some extent by both boys and girls of the sixth grade level. Two new games are introduced at this level—Line Soccer and Hit-pin Ball.

TABLE VIII

POPULAR GAMES IN THE SIXTH GRADE (Boys)

1. Dodgeball	116	6. Prisoner's Base	18
2. Kickball	35	7. Jump the Shot	18
3. Bombardment	33	8. Endball	15
4. Club Snatch	31	9. Line Soccer	14
5. Pom-Pom-Pull-Away	20	10. Hit-pin Baseball	14

Physical Education in the Junior High Schools of Illinois

By C. O. Jackson
University of Illinois

INTRODUCTION

THIS study was financed by the State Department of Physical Education, and carried on with the advice and cooperation of the following State Curriculum Group, Junior High School Physical Education Division:

Men's Committee.—
W. O. Alstrom, University High School, Urbana;
D. G. Busey, Thornburn Junior High School and Public Schools, Urbana;
R. N. Clark, Principal, Junior High, Quincy;
R. O. Duncan and A. E. Florio, University of Illinois, Urbana;
O. E. Metcalf, High School, Crystal Lake;
C. O. Jackson, University of Illinois, Urbana, Chairman.

Women's Committee.—
Margarite Barto, Illinois State Normal, Normal;
Dorothy Cruise, High School, Decatur;
Florence Lawson, University of Illinois, Urbana;
Dorothy McClure, James Millikin University, Decatur;
Alma Wingeir, Illinois State Normal, Normal.
Esther Hume, Illinois State Normal, Normal, Chairman;

PURPOSE

The purpose of the study was to secure information relative to the present practices in the conduct of the curriculum of physical education in the junior high schools of the state. It was hoped that the data thus secured might be helpful in aiding the committee in the construction of a suitable state curriculum outline for that level. A further goal was to secure supplementary data to correlate with an earlier study on the high school level.[1]

PROCEDURE

Inquiry blanks were sent to the principals of the sixty junior high schools, listed as such in the Illinois School Directory, 1937-38, with a short letter explaining the purpose of the study, and limiting its scope specifically to the curriculum in physical education. A stamped and self-addressed envelope was enclosed. Follow-up cards were later sent to a few schools which had not responded by a certain date.

[1] C. O. Jackson, "The Status of Physical Education in the Accredited Secondary Schools of Illinois," Research Quarterly, 9:1 (March 1938) 47.

DISCUSSION

Schools returning the inquiry blanks were grouped according to enrollment as follows: I—less than 100; II—100 to 249; III—250 to 499; IV—500 to 999; V—1000 and over.

A number of the blanks were not checked completely, or filled out so that certain items could not be included in this summary. The total responses, therefore, vary from table to table, and within the tables, the sub-totals do not always equal the total. While most of the tables which follow are self-explanatory, the essential facts which they contain will be mentioned briefly following each, and the conclusions and implications discussed after the last table has been presented.

While there appears to be no valid way of checking the reliability of the data secured, the study does appear to be significant since fifty principals, representing 83.6 per cent of the schools reached, cooperated by filling out and returning the blanks. A number wrote personal letters, or included supplementary data which helped make the local curriculum easier to visualize.

It was apparent from the returns, however, that not all the schools listed as junior high schools included the seventh, eighth, and ninth grades. In a few cases only the seventh and eighth grades were included, while in several other instances, the eighth and ninth grades alone made up the junior high. No attempt was made in the study to differentiate between these varying types of junior high schools.

Following are copies of the letter and inquiry blank sent to principals:

October 25, 1937

To Principals of Junior High Schools in Illinois:

We are asking your cooperation and help in securing information relative to the present curriculum in physical education in the junior high schools of the state. This study is being carried on by a division of the State Curriculum Committee in order to secure data which may be helpful in the formation and development of a state curriculum outline in physical education.

You can materially assist the committee by filling out the enclosed inquiry blank and returning it promptly, using the enclosed stamped and addressed envelope. Additional help in the form of suggestions, curriculum outlines, and the names of persons carrying on outstanding work in physical education at this grade level will be greatly appreciated.

Although it is quite certain that many of the schools included in this survey have excellent outlines in health and safety, it is the purpose of the present study to include *only* the curriculum in physical education. This means also that except for one question on the inquiry blank, the study is *not* concerned with the extracurricular programs in intramurals and interscholastic athletics.

Data secured through a similar study on the secondary level, carried on recently in this state by the Illinois Physical Education Society with the co-

operation and assistance of the Bureau of Research, indicates that a survey such as this has a definite value. Your cooperation in making this study complete and worth while is earnestly solicited.

Sincerely,

STATE CURRICULUM COMMITTEE
Division of Junior High School
Physical Education

INQUIRY BLANK

Status of Physical Education in the Junior High School

School..... Enrollment..... Boys..... Girls.....

Please read the following statements *carefully* and answer each one specifically as it applies to your own situation. Check, or fill in the correct items. See the accompanying letter for explanations. Use the back of the sheet for additional information and comments.

1. Is physical education required? Yes ☐ No ☐ For six semesters ☐ four semesters ☐ two semesters ☐ daily ☐ four times a week ☐ three times a week ☐ twice a week ☐ less ☐ Length of periods (exclusive of showers and dressing) 60 minutes ☐ 45 minutes ☐ 40 minutes ☐ 35 minutes ☐ 30 minutes ☐ 25 minutes ☐ less ☐.

2. Do your teachers of physical education follow a curriculum outline (course of study)? Boys: Yes ☐ No ☐ Girls: Yes ☐ No ☐ Is this a syllabus for the local school? Boys: Yes ☐ No ☐ Girls: Yes ☐ No ☐ Do you have a copy in your office? Boys: Yes ☐ No ☐ Girls: Yes ☐ No ☐

3. Is the class period in physical education devoted largely to *instruction* in specific activities? Boys: Yes ☐ No ☐ Girls: Yes ☐ No ☐ Is the class period devoted largely to *play?* Boys: Yes ☐ No ☐ Girls: Yes ☐ No ☐

4. What is the training of your teachers of physical education?

Teachers	Degree	Institution	Semester hours of training in P.E.	Hours per week in P.E. classes	Hours per week in other subjects
Men					
Women					

5. How many of your teachers are members of the American Association for Health, Physical Education, and Recreation?..... Illinois Physical Education Association?.....

6. What is the source of funds for physical education? Board of Education? ☐ Athletic fund ☐

What is the approximate amount of money available for supplies and equipment each year in physical education?.....

7. What type of gymnasium do you have? Regulation ☐ Auditorium gym. ☐ ..... ☐ How many periods a week during the school day is this available? (.....) For boys (.....) For girls (.....).

8. Do you have a program of intramural sports? For boys ☐ What sports?..... For girls ☐ What sports? .....

Do you have a program of interscholastic sports? For boys ☐ What sports?..... For girls ☐ What sports? .....

9. Do you consider your present curriculum in physical education as complete and worth while as the other curricula in your school? Boys: Yes ☐ No ☐ Girls: Yes ☐ No ☐

Please include on the back of this sheet any information which will further describe the present curriculum in physical education for boys and girls.

Thank You for Your Interest and Cooperation

ANALYSIS OF THE DATA

The information received from the survey has been assembled in seven tables which are included and discussed in the following section.

TABLE I

ORGANIZATION OF THE CURRICULUM IN PHYSICAL EDUCATION

	Schools Required		Semesters				No. of Meetings Weekly				Length of Periods							
	Yes	No	6	4	2	less	4	3	2	1	60	50	45	40	35	30	25	less
I	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
II	10	2	3	7	2	0	0	3	9	1	0	0	5	5	0	1	0	0
III	19	2	9	7	2	0	0	0	11	6	3	1	4	2	5	3	1	0
IV	12	0	8	3	1	0	0	4	7	1	1	0	3	2	5	0	0	0
V	4	0	3	1	0	0	0	2	1	0	0	0	3	0	0	1	0	0
Total	46	4	23	19	5	0	0	9	28	9	4	1	15	9	10	7	1	0

Forty-six of the fifty schools responding require physical education as part of the school program, and of the four which do not require it, three do not offer it. Four schools of the forty-six require physical education of the boys but do not offer it to the girls. Half of the schools require it for six semesters, or the entire three years of the junior high schools, while the same number require it for four semesters. It is likely that there are a few junior high schools which include only the seventh and eighth grades in this latter group.

The majority of the schools have two meetings per week of the classes in physical education, while approximately one-fifth of those responding have either three meetings, or one meeting weekly. Not a single school indicates daily periods, but it is possible that several of them have classes in health education the other two or three periods of the week.

While the length of the periods varies from one hour to twenty-five

minutes, exclusive of time for dressing and showers, most of the schools indicate from thirty-five to forty-five minutes.

TABLE II
CURRICULUM OUTLINE AND ESTIMATE OF THE CURRICULUM

School	*Cur. Outline* Boys Yes	No	Girls Yes	No	*Local Syllabus* Boys Yes	No	Girls Yes	No	*Office Copy* Boys Yes	No	Girls Yes	No	Members of I.P.E.S.	A.A.H.P. E.&R.	*Good Curriculum* Boys Yes	No	Girls Yes	No
I	0	1	0	1	0	1	0	1	0	1	0	1	0	0	0	2	0	1
II	5	7	6	6	4	5	4	5	2	10	4	7	9	3	4	8	4	8
III	8	8	8	6	7	6	6	6	6	10	6	8	2	2	4	14	3	13
IV	9	1	9	1	7	3	6	3	6	3	5	3	5	2	7	5	7	6
V	4	0	3	0	1	1	1	1	3	0	2	0	1	1	3	1	3	1
Tot.	26	17	26	14	19	16	17	16	17	24	17	19	17	8	18	30	17	29

Slightly more than half of the schools responding indicate in Table II that the Department of Physical Education follows a curriculum outline, while not quite as many of these state that this is a special outline for the local situation. One-third of the group state that a copy of the curriculum outline for both boys and girls is in the office of the principal, but the majority answer this in the negative.

Approximately one-third of the teachers of physical education are affiliated with a state association, the Illinois Physical Education Society, but less than one-sixth are members of a national organization, such as the American Association for Health, Physical Education, and Recreation. The schools with an enrollment of from one hundred to two hundred fifty have the largest number of members.

The principals were asked the question, "Do you consider your present curriculum in physical education as complete and worth while as the other curricula in your school?" The last part of Table II gives this data. With more than half of the principals (approximately 60 per cent) indicating a negative answer, it is apparent that most of the expressed dissatisfaction occurs in those schools with enrollments of up to five hundred. In a few cases where the principals made an affirmative answer, additional remarks seemed to indicate that this was based on a tentative or proposed plan for reorganization of the present curriculum rather than one which was at present acceptable to them.

An additional question not listed in the table was "Is the class period in physical education devoted largely to *instruction* in specific activities or to *play*?" Twenty-two of the group responding for boys physical education answered in the affirmative for the first part of the question, while twenty-five schools gave the same answer for girls physical education. A consideration of the second part of the questions shows that twenty-seven of one group (boys) and twenty-four of the other (girls) answered in the affirmative. It is interesting to notice that while more of the schools indicate that the class period is largely devoted to play, this practice occurs most frequently in the small and medium sized

schools with enrollments of one hundred to five hundred. These represent 88 per cent of the group cooperating in the study.

TABLE III
INTRAMURAL SPORTS

	BOYS						GIRLS				
School	Bask. ball	Base- ball	Soft ball	Track	Vol. ball	Touch Ft. ball	Base- ball	Vol. ball	Bask. ball	Misc.	Soccer
I	0	0	0	0	0	0	0	0	0	0	0
II	8	9	1	3	2	1	8	5	7	0	3
III	18	7	7	4	3	1	7	6	7	4	0
IV	11	4	6	5	5	3	5	6	4	7	1
V	3	1	2	1	1	0	3	3	2	0	1
Total	40	22	16	13	11	5	23	20	20	11	5

As might be expected, basketball is the most popular intramural sport for boys, judging by the number of schools which list it as part of their out-of-school program. Baseball, softball, track, volleyball, and touch football follow in order. Horseshoes are mentioned as activities four times; tennis and table tennis three times; golf, soccer, and swimming twice; and marbles, shuffleboard, handball, and wrestling once.

For girls, the most popular sport as indicated in Table III is baseball (softball) followed closely by volleyball and basketball. Miscellaneous games, including archery, tetherball, darts, health ball, table tennis, marbles, dodgeball, and deck tennis are next followed by soccer. Other activities listed too few times to appear in the table are tennis, swimming, and track (two schools) and golf (one school).

The great majority of the activities emphasized for both boys and girls are team sports, and most of them would come under the classification of "varsity sports." It is highly probable that in most of the schools where basketball for girls is indicated as an intramural activity, the game played is either nine-court basketball, or basketball played according to girls' rules.

It is apparent that the larger the school, the greater the variety of sports offered the students, and the smaller the school, the fewer the opportunities for much choice.

TABLE IV
INTERSCHOLASTIC SPORTS

	BOYS							GIRLS			
School	Bask. ball	Track	Foot- ball	Base- ball	Soft- ball	Tennis	Vol. ball	Base- ball	Bask. ball	Vol. ball	Swim- ming
I	1	0	0	0	0	0	0	0	0	0	0
II	10	3	3	6	0	1	0	2	2	1	0
III	17	11	5	4	3	0	1	1	1	0	1
IV	10	9	7	3	0	0	0	0	0	0	0
V	3	2	1	0	1	1	1	0	0	0	0
Total	41	25	16	13	4	2	2	3	3	1	1

Most of the schools, 82 per cent in fact, indicate that basketball is the chief interscholastic sport for boys. Less than half that number offer opportunities in track, while football, baseball, softball, tennis, and volleyball follow in rapidly diminishing frequency. Golf, soccer, and swimming are listed only once, and then in the larger schools.

A definite minority, one-third of the schools, offer football on an interscholastic basis.

The second part of Table IV indicates that an extremely small number, 6 per cent of those responding, offer either baseball or basketball as an interscholastic sport for girls.

The entire offering in the program in interscholastic sports for both boys and girls is definitely of the "team" type, and almost no emphasis is placed on the "individual" type of activity.

TABLE V

DEGREES OF TEACHERS

	MEN						WOMEN					
	B.S.	B.E.	A.B.	M.A.	B.P.E.	None	B.S.	A.B.	B.E.	M.A.	B.P.E.	None
I	0	2	0	0	0	0	0	1	0	0	0	0
II	4	1	3	1	0	6	3	3	2	1	0	4
III	9	7	5	2	0	1	6	4	2	0	1	3
IV	4	1	3	0	2	4	3	2	1	2	0	3
V	2	2	1	0	0	1	1	1	2	0	0	0
Total	19	13	12	3	2	12	13	11	7	3	1	10

A consideration of the training of teachers reveals that:

Of the sixty-two men, nineteen or approximately 31 per cent, and of forty-five women, thirteen or 38 per cent, have the same degree. The summary also shows the increasing number of teachers with Bachelor of Education degrees from State Teachers Colleges.

The most startling fact which the table presents is the number of teachers without any degrees whatever. Twelve of the men, or 20 per cent of their group, and ten of the women, or approximately the same percentage, are listed as lacking such qualifications. In several instances, these instructors have a certificate to teach physical education from a gymnastic course, or have completed two or three years toward a degree.

TABLE VI

SEMESTER HOURS TRAINING IN PHYSICAL EDUCATION AND TEACHING LOAD

	SEMESTER HOURS										TEACHING LOAD			
	0 - 4		5 - 9		10-19		20-29		30 - up		Avg. Hours in P.E. class		Avg. Hours in other sub.	
	M	W	M	W	M	W	M	W	M	W	Men	Wom.	Men	Wom.
I	2	1	0	0	0	0	0	0	0	0	2	1	25	25
II	1	3	1	3	4	3	3	0	1	4	8	8	19	16
III	3	4	5	7	8	1	4	1	7	5	7	10	16	16
IV	1	2	2	2	4	0	0	1	7	7	20	21	6	6
V	0	0	0	0	1	0	3	0	1	5	22	27	7	5
Total	7	10	8	12	17	4	10	2	16	21	Avg. 11.3	13.4	14.6	11.6

A survey of the semester hours of training in physical education reveals some enlightening facts. While forty-seven men, or 77 per cent of that group, and twenty-seven women, or 56 per cent, appear to have the equivalent of a minor or major in this field, fifteen men and twenty-two women have less than ten hours special training. When these last figures are considered along with the fact that twelve men and ten women had no college degrees whatsoever, it appears logical to assume that many teachers who are listed as teaching physical education are inadequately trained in that field.

Usually, the larger the school the more hours of special preparation the instructor has had in physical education, but there are two instances where teachers in the largest schools do not even possess a degree.

The teaching load at first glance appears to be satisfactory, with the usual load from twenty-three to thirty-two hours. The table, however, includes only the hours spent in conducting classes, when as a matter of fact the majority of both men and women spend from eight to ten additional hours weekly coaching sports, directing intramurals, or conducting other extracurricular activities. With these facts in mind, it appears quite obvious that in most cases the teaching load is excessive.

The table also indicates that on an average the men spend slightly less time in teaching physical education classes and more time teaching other subjects than do the women. However, the coaching duties of the men probably increase the total load in physical education.

As might be expected, the study shows that the number of hours spent by the instructor in the teaching of physical education increases in direct ratio to the size of the school. At the same time there is a corresponding decrease in the amount of time devoted to the teaching of academic classes.

TABLE VII

FUNDS FOR THE CURRICULUM IN PHYSICAL EDUCATION, AND THEIR SOURCES

	AMOUNT							SOURCE			
Sch.	$25-50	50/100	100/200	200/300	300/400	400/500	750	Bd. Educ.	Ath. Funds	Entertainments	Fee
I	0	0	0	0	0	0	0	0	1	0	0
II	2	4	2	0	0	0	0	9	2	0	1
III	2	4	1	1	0	0	0	17	0	0	0
IV	0	4	1	2	1	1	1	8	1	2	1
V	1	0	1	0	0	0	0	3	0	1	0
Total	5	12	5	3	1	1	1	37	4	3	2

Table VII indicates that most of the schools receive an annual appropriation from the Board of Education of $50 to $200, exclusive of salaries, for the conduct of the curriculum in physical education. On the basis of allowance per pupil, this appears to be woefully inadequate, especially in the larger schools. The returns for this question were not

complete as a number of principals omitted to fill in the answer, and several merely answered "don't know!"

If the usual policy is followed of permitting the classes in physical education to use some of the equipment for varsity teams, purchased by the athletic association, the situation is not quite as hopeless. However, a curriculum based on the thesis that it should consist almost entirely of varsity sports must surely be lacking in emphasis on recreational and other carry-over activities.

Another question concerning the type of gymnasium and the periods that were available for boys or girls was asked. Seventeen or 34 per cent of the schools have a combination auditorium-gymnasium, while the balance have the regular type gymnasium. The data indicates that in practically all cases boys and girls have equal opportunities for using the gymnasium during the school day and that these opportunities are adequate for the conduct of a curriculum in physical education.

SUMMARY AND CONCLUSION

The typical junior high school in the State of Illinois, as pictured in the present study, has an enrollment somewhere between two hundred fifty and five hundred pupils, requires physical education participation of all students for six semesters, and requires attendance two periods of forty to forty-five minutes (exclusive of dressing and showers) each week.

The instructors in this school, usually a man and a woman, have either a Bachelor of Science, Bachelor of Education, or a Bachelor of Arts Degree with majors in one or more academic fields. They are not affiliated with any state or national organization in physical education and probably have the minimum preparation, or slightly less, for a minor in the field. Most of the training, as well as the present interests of these instructors, is concerned primarily with the teaching of a heavy schedule of academic or vocational subjects to which they devote most of their time.

The periods of physical education carried on for the most part in a regulation gymnasium are devoted largely to play as opposed to specific instruction in a variety of activities, and the chances are fifty-fifty that the instructors in this school follow curriculum outlines which have probably been developed for the local situation. The principal may possibly have copies of these in his office.

The Board of Education furnishes from $50 to $200 annually for the conduct of the curriculum but the instructors must depend on the athletic association for the loan or use of additional sports equipment.

The opportunities in intramurals for boys are very meager, with most emphasis on a few highly organized team sports such as basketball, baseball, and softball (which may comprise the major part of the curricular offerings). Basketball is by far the most important interscholastic sport.

The program in intramurals for girls is probably broader and better balanced than the boys. Practically no emphasis is placed on interscholastic athletics for girls.

The principal of this school does *not* "consider (the) present curriculum in physical education as complete and worth while as the other curricula in (the) school, largely because of lack of adequate time, facilities, organization and administration."

IMPLICATIONS

It is quite evident that the majority of the junior high schools in the state are only slightly better in the conduct and organization of the curriculum in physical education than the secondary schools.[2]

The nation-wide trends as stated by Rogers indicate some worthwhile goals for the junior high schools in Illinois. He finds that there "is a steady growth in time allotment, especially in the junior high schools" but points out that "there is much to be done in reaching a standard which is a daily period of physical education throughout the twelve grades." [3] Such a standard was set up by the Committee on Curricula for the Junior and Senior High Schools, Department of Superintendents, National Education Association, in 1928. Other trends mentioned are that ". . . States are setting up better standards and higher requirements in all the branches and fields as regards facilities, time allotment, teacher training, and credit; . . . coeducational and corecreational programs are being developed especially in the junior and senior high schools . . . (and) a wider enriched program to include a variety of activities is being encouraged."

The professional objectives for physical education in the secondary schools, adopted by the American Physical Education Association, enlarge the scope of the goals just mentioned and apply equally well to the junior high school. These are:

1. A medical examination for every school child.
2. Health habits that endure.
3. A class period in physical education each day.
4. A gymnasium and playground for every school.
5. A teacher fully trained and accredited.
6. The coach a member of the faculty.
7. A graded and scientific curriculum.
8. Standardized physical efficiency tests.
9. Positive credit for physical education activities.
10. Education for leisure.
11. An intramural program for after-school hours.
12. A varsity program that stresses sportsmanship and ethical conduct.

Institutions preparing teachers, and especially the State Department

[2] C. O. Jackson, *op. cit.*

[3] J. E. Rogers, "Modern Trends in Physical Education," *National Physical Education Service News Letter*, 106, p. 7–8.

of Public Instruction, can be tremendously important factors in bringing about worth-while developments. The study indicates definitely a vital need for good curricula administered by adequately trained teachers. However, the principal of each individual junior high school is in the best position to see that his school has trained, professionally minded teachers who strive for and approach recognized goals in the field of physical education and recreation. The scope and quality of the curriculum rests with him.

Acknowledgments.—The study was made possible through the cooperation and financial assistance of Don Cash Seaton, State Director of Physical Education, who sent out the blanks and the mimeographed summary from his office.

Special acknowledgment should also be made for the help of the following: the principals of fifty junior high schools in the state who gave generously of their time in filling out and returning the blanks which made the study possible; Harold W. Gordon, Director of Physical Education, Abraham Lincoln Junior High School, Rockford, who sent copies of an excellent curriculum to the chairman; and James Riva, University of Illinois student, and N.Y.A. assistant who helped with the tabulation.

The Status of Health and Physical Education for Women in Negro Colleges and Universities

By A. W. Ellis

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DURING the past ten years, rapid changes and extensive experiments have taken place throughout the field of liberal education in Negro colleges and universities. The changes have occurred primarily in educational policies, but have often been influenced to a marked extent by the necessity for reduction in student expenses. The attempt to balance the school budget, with a limited amount of funds, leads to drastic cuts in all departments, and almost to the exclusion of some important departments. Perhaps the department which suffered most was that of health and physical education.

In Negro colleges the tendency has been toward acquiring academic training. Little attention has been given to the care and protection of health, to the building of strong well-developed bodies, or to the teaching of proper recreational activities. In most cases, however, some attention has been given to competitive athletics for men, such as football, basketball, baseball, and track; but little, if any, attention has been given to physical activities for women.

PURPOSE OF THIS STUDY

Because of the writer's interest in the present status of health and physical education for women in Negro colleges and universities, this study was made. The purpose was to determine the history and present practices of health and physical education for women in those institutions.

METHOD OF PROCEDURE

The data were obtained by questionnaire method. A questionnaire was sent to the presidents of 67 institutions. Other sources of materials were catalogues, bulletins, and supplementary printed matter issued by these institutions. Visits were made by the writer to most of the schools, by which means he was able to secure first-hand information as a check up on the questionnaires and statements found in printed documents.

TABLE I

REPLIES FROM SCHOOLS ON THE STATUS OF HEALTH AND PHYSICAL EDUCATION FOR WOMEN IN NEGRO COLLEGES AND UNIVERSITIES*

	Liberal Arts Colleges	Teachers Colleges	Junior Colleges	Section
	1	2	–	East
	20	2	4	South
	16	–	–	Southwest
	6	1	–	Midwest
Totals	43	5	4	

* Number of questionnaires sent out, 67; number of questionnaires returned, 52, or 77.67 per cent.

Table I shows that liberal arts colleges outnumber teachers colleges by a large margin. Teachers colleges barely outnumber junior colleges. Yet it was revealed in the information received that there seems to be a tendency away from junior colleges with a two-year curriculum toward teachers colleges with a four-year curriculum.

The topics upon which information was secured can be seen in Table II. Data under each separate topic were tabulated and summarized on the basis of the four main geographical divisions of Negro Institutions throughout the country: east, south, southwest, and midwest: also on the three types of institutions: universities and liberal arts colleges, teachers colleges, and junior colleges.

Tabulation of the data received show the following:

1. Health and physical education are required for graduation in half of the institutions responding.

2. More than 50 per cent of the institutions have trained directors in charge of the departments.

3. There was no record found as to the first institution to offer health and physical education in its curriculum.

4. Less than half of the institutions have health clinics on the campus.

5. Nearly all of the institutions devote some time to school and personal hygiene.

6. A large number of the institutions do not charge students medical fees, but send all bills for such to the parents.

FURTHER DATA

Of the sixty-seven institutions used in this study, responses from fifty-two, or 77.67 per cent, were received. More than 50 per cent of the institutions responding require health and physical education two years, twice a week, for graduation.

Six of the leading colleges called attention to the fact that although two years, twice a week, of physical education were the requirements for graduation, this credit was not included in the 120 semester hours. More than half of the institutions responding have departments of health and physical education with trained directors in charge. Some

TABLE II

STATUS OF DEPARTMENTS OF PHYSICAL EDUCATION FOR WOMEN IN NEGRO COLLEGES AND UNIVERSITIES

Questions	Liberal Arts Colleges		Teachers Colleges		Junior Colleges		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1. Do you have a department of physical education?								
Yes	24	55.81	2	40	2	50	28	53.85
No	10	23.26	3	60			13	25.00
A. Do you have a physical director in charge?								
Yes	22	53.49	1	20	1	25	25	46.35
No	5	11.63	1	20			6	11.73
B. How many regular teachers make up the dept.?								
Female	21	48.84	4	80	1	25	26	50.00
C. How many part time teachers do you use?								
Female	7	16.25	2	40			9	17.35
D. Do you use female student instructors?								
Yes	15	34.84					15	28.86
No	7	16.25	3	60	1	25	11	21.15
E. Do you have a gym?								
Yes	16	37.29					16	30.76
No	8	18.64	3	60	2	50	13	25.00
F. Name the first Negro institution to offer health and physical education for women [1]								
2. Is physical education:								
required	25	58.11	4	80	1	25	30	57.69–
elected	7	16.25					7	13.46
A. Time in years								
One								
Two	22	51.11	5	100	2	50	29	55.77
Three	1	2.33					1	.199
Four	4	9.32					4	
B. Periods per week:								
Two	19	44.18	3	60	2	50	24	46.35
Three	5	11.63					5	9.63
C. Specific activities required:								
By college	5	11.63	3	60			8	15.4
By department	6	13.98	2	40	1	25	9	17.35
Rhythms	16	37.29	4	80			20	38.46
Sports	23	54.40	5	100	2	50	30	57.69
Gymnastics	15	34.84	2	40			17	32.69
Others	5	11.63	3	60			8	15.4

[1] No record found, but it is believed by the majority that Hampton Institute was the first.

TABLE II (Cont'd)

STATUS OF DEPARTMENTS OF PHYSICAL EDUCATION FOR WOMEN IN NEGRO COLLEGES AND UNIVERSITIES

Questions	Liberal Arts Colleges		Teachers Colleges		Junior Colleges		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
3. Do physical education courses receive credit?								
Yes	16	37.29	5	100	1	25	22	42.34
No	8	18.64			1	25	9	17.35
A. Number of units obtainable. Semester hours:								
Two	23	55.81	1	20	2	50	26	50.00
Three	9	20.93					9	17.35
Four	4	9.32	5	100			9	17.35
B. Credits toward degree:								
One year	10	23.26					10	19.23
Two years	15	34.84	5	100	2	50	22	42.34
C. Is physical education required without credit for graduation?								
Yes	12	27.96	4	80	1	25	17	32.69
No	10	23.26	1	20	1	25	12	23.27
D. Do you give A.B. or B.S. Degree in education with a major in physical education?								
Yes	10	23.26					10	19.23
No	33	76.74	3	60	1	25	37	71.15
4. Underscore expressions which have been anaugurated in your institution since 1930. A. Physical Education required of all students for two or three years.								
Yes	33	76.74	3	60	1	25	37	71.15
B. Varsity members exempted from physical education classes.								
Yes	4	9.16			1	25	5	9.63
C. Specific number of required hours for teachers' certificate.								
Yes	16	37.29	3	60			19	36.52
D. A greater emphasis placed on intramural sports.								
Yes	15	34.84	4	80	1	25	20	38.46

TABLE II (Cont'd)
STATUS OF DEPARTMENTS OF PHYSICAL EDUCATION FOR WOMEN IN NEGRO COLLEGES AND UNIVERSITIES

Question	Liberal Arts Colleges		Teachers Colleges		Junior Colleges		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
E. Curtailment of courses due to budget cut.								
Yes	4	9.32	1	20			5	9.63
5. Are physical and and medical examinations required of all students?								
Yes	43	100	5	100	4	100	52	100
1. Yearly	37	86.05	3	60	3	75	43	82.69
2. Semi-annually	6	13.8	2	40	1	25	9	17.38
A. Persons on staff.								
Nurses	25	58.11	2	40	3	75	30	57.69
Doctors	30	69.76	3	60	1	25	34	65.38
Instructors			5	100	2	50	7	13.46
B. Are they full time?								
Yes	17	39.52	3	60	1	25	21	40.03
No	10	23.26					10	5.20
C. Does the college require a medical fee?								
Yes	30	69.76	2	40	1	25	33	63.46
No	11	25	2	40			13	25.00
D. Is health education required without credit toward a degree?								
Yes	21	48.84	4	80			25	48.00
No	15	38.84					15	28.96

comments were made to the effect that directors who were not trained, attended summer schools.

Of the institutions responding, twenty-one colleges, one teachers college, and one junior college reported that although they did not have a modern gymnasium fully equipped, they did have access to special rooms and in some cases condemned frame buildings that were used for classes and for indoor activities. Almost three-fourths of the institutions do not require any specific skills or set any definite standards of achievements. However, all freshmen and sophomores must join some intramural team or hobby club for physical activity both semesters through the sophomore year.

Twenty-three per cent of the colleges and universities responding offer A.B. or B.S. degrees with a major in health and physical education. Only six of these institutions made special mention of the fact that they had swimming pools in their gymnasiums. More than 25 per cent of the institutions report changes in freedom of choice of activities and in general a more liberal attitude toward the inclusion of recre-

ation activities, but specifically an objection to inter-collegiate sports for women.

Of the teachers' colleges responding, 60 per cent called attention to the fact that, in order to meet the state requirements for the "A" certificate, it was necessary to increase the units of health and physical education academically acceptable for graduation, from four to six.

Less than 86 per cent of all the institutions require annual physical and medical examination of all students as part of the entrance requirements. In some cases students were allowed to have their family physician fill out the examination blank and mail it directly to the institution. Twenty per cent of the fifty-two institutions used in this study, have clinics or hospitals on the campus with a full time physician and nurse on the staff. Others commented on the fact that they had access to city hospitals for serious cases. It is interesting to note that, eleven colleges, two teachers colleges, and three junior colleges do not charge students medical fee. However, it is the policy of these institutions to make the student pay for all personal hospital or medical emergencies.

Only 40 per cent of the schools listed the general courses offered in health education: personal and school hygiene, physiology, and anatomy. A large number of the institutions require one semester of health education without credit toward the degree.

Attention is called to the answers given to question (F) under No. 1: "Name and give the year of the first Negro institution to offer health and physical education for women." No record was found as to the first institution to offer a program of health and physical education for women. Fifty per cent of the schools answering stated that it was their belief that Hampton Institute, Hampton, Virginia, was the first to offer such a course.

"The history of physical education in Negro colleges and universities up to 1918 points to a strictly athletic program, consisting of such activities as: football, baseball, tennis, and a little track." [1]

Although it was not definitely stated that the above mentioned program was restricted to men only, the writer is of the opinion that it was; and that no consideration whatever was given to the women, except in cases where a few showed some particular interest in learning to play tennis. With the coming of Brock, (West Virginia State College) Kindle, (Talladega) and Williams, (Hampton Institute) the modern conception of physical education made its appearance in Negro institutions.

CONCLUSIONS

The findings in the study seem to justify the following general conclusions.

[1] J. H. Burr, *A Survey of Physical Education in Negro Colleges.*

1. That the status of health and physical education in Negro colleges and universities is, in general, comparatively low.

2. Most of the institutions under consideration have some type of recreational program for women; but only a few colleges have initiated a definitely well-planned program of health and physical education for women.

3. The two-year physical education required course offered in most colleges for graduation is generally a routine course, which is not designed to meet the physical needs of individual students.

On the basis of the results found, the writer wishes to make a suggestion for a sound standardized program of health and physical education. I would recommend a more flexible program that will fit the individual needs of students. The most outstanding prerequisite for such a program is a thorough physical examination by the college physician. Following the examination it is suggested that students be grouped as follows:

A. Students who are sufficiently high grade in development and endurance to take part in vigorous activities.

B. Those who have one or more physical defects, none of which are serious enough to curtail a normal program of activities.

C. Those whose physical status is such as to prohibit them from carrying a normal program. This group may, however, be assigned to classes in restricted or moderated recreational activities.

D. Those who on account of one or more uncorrectable physical defects are rendered unfit for any program of physical activities; or, in cases where the defects are found correctable within the means of the department, they may be assigned to individual treatment in physical therapy or corrective exercises.

Such a program would help the round shouldered girl and the excessively fat girl to develop a symmetrical figure; the girl with the weak heart to engage in harmless activities and perhaps help her gain physical strength. With proper supervision many deformities may be corrected by some treatment in the department.

It is the writer's sincere opinion that careful attention should be given to methods of developing strong, well-formed bodies.

A Method to Increase the Validity of Measuring Posture

By Edward Martin Korb
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INTRODUCTION

At the present time the methods of grading posture range from the simple window-pole test to the more complicated methods of determining body angles that require intricate apparatus. Regardless of the methods used to determine posture, we must first of all know what good posture is. It is essential, therefore, that we have a standard of comparison, or a norm. Without this the results would be meaningless. One need look no farther than the home to find several standards. The foot ruler is a standard for linear measurement, the quart measure is a standard of liquid measurement, while the pound is a standard of weight. The necessity for standards is so essential that they are universally accepted.

If two objects are compared to a standard, then the relationship between the two objects can be determined, but if the same objects are not compared to a standard then the relationship between them remains unknown. For instance, let us compare two objects to a pound weight. The first object is just twice as heavy as the weight, while the second object is four times as heavy as the weight. Now we not only know the exact weight of each object, but we can compare the two against each other and show that one is twice as heavy as the other. Maybe the smaller object was the heavier, or, maybe the two appeared the same weight, but regardless of how they appeared, with a standard of comparison we have an accurate measurement.

The question naturally arises, are standards used in posture rating, and do the standards agree with each other? One standard says that if an individual's horizontal height equals his vertical height he has good posture, while another standard says that if certain of the body segments are in such a position that a plumb line will bisect them, then that person has good posture. Another method used is to compare an individual, or his picture, to a master chart and determine his rating from the picture on the chart with which he is most closely identified. A method commonly used is the subjective method, or, guessing the grade after a visual inspection, based on the opinion of the examiner. Needless to say the standard of good posture is only in the mind of the judge. If the judge's standard of good posture happens to be erroneous, then, of course, all deductions are erroneous also. Each judge

has his own personal mental standard, and the standards vary as much as the judges themselves. Cureton found that the subjective method of grading posture was merely 13.4 per cent better than pure chance guesses on the average,[1] while Brownell showed that even with experts doing the rating some individuals were given a rating of A, B, C, and D.[2] That is, one subject was judged as best by one judge and poorest by another judge.

This subjective method is frequently used in grading silhouettes. It is obvious, therefore, that some method of grading posture from the silhouettes is needed that will increase the validity and reliability of the present method. Such a method will be discussed that will not only increase the validity and reliability, but is also time saving and economical.

THE COMPAROGRAPH

The Comparograph provides a method of taking shadow silhouetteographs in which, when the pictures are developed, the subject's posture is contrasted with excellent posture all in the same picture. In other words, an outline or a norm is painted on the curtain before which the subject stands. The outline is plainly seen all around the individual. Any deviation from the norm may be detected in a glance. The outline is a standard of excellent posture. It does not vary from time to time. It is stable and consistent. The same norm is used on all tests, and the subjective judgment, or the judge's opinion of excellent posture, is eliminated.

HOW THE NORM WAS ESTABLISHED

The norm used on the outline was set up as the standard of excellent posture by Klein.[3] This standard is a composite silhouette based on the examination of 2200 subjects. In establishing the standard the head was balanced above the shoulders, the chest elevated and the breast bone the part of the body farthest forward, the lower abdomen drawn in and flat, and the back curve not exaggerated. In the lateral view the body parts were so aligned that a perpendicular dropped from the ear or just behind it would fall through the shoulder and hip joints, and either through the ankle joints or just in front of them. Whether this particular standard or some similar standard is used matters little. Some standard must be accepted which meets the requirements of excellent posture according to our present-day knowledge of what excellent posture is. This particular standard is merely one of several possible choices and meets the accepted requirements. It includes all the characteristics of excellent posture.

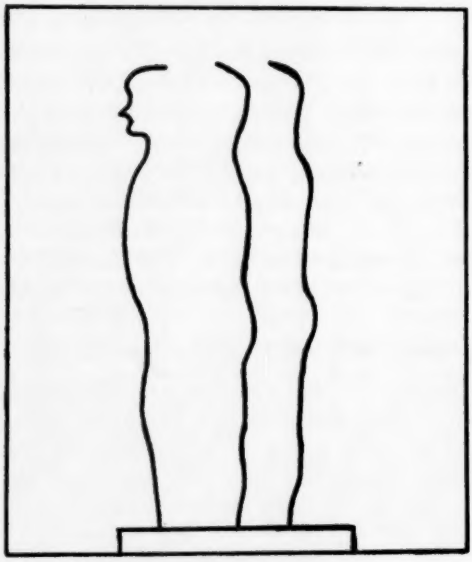
[1] T. K. Cureton, "Reliability and Objectivity of the Springfield Postural Measurements," SUPPLEMENT TO THE RESEARCH QUARTERLY, 6:2 (May, 1935).

[2] C. L. Brownell, "A Scale for Measuring the Anteroposterior Posture of Ninth-Grade Boys," Teachers College, Columbia University, Contributions to Education No. 325.

[3] Armin Klein, "Posture and Physical Fitness," U. S. Dept. of Labor, Bureau Publication 205.

HOW IT WAS PUT ON THE CURTAIN

The process of taking a 2½″ silhouette and tracing it on a curtain as a 6′ 4″ outline was quite simple. First of all the silhouette was traced on a small piece of cellophane and then placed between two pieces of glass 3¼ x 4 inches. This home-made slide was then placed in an ordinary slide projector used for projecting still slides, and the silhouette was cast onto the black curtain that had been tacked onto the wall. With the outline enlarged to the proper size and the curtain lined up with a plumb line, the front, or anterior portion of the silhouette, was traced with chalk. Instead of tracing the posterior part of the image as it was, it was moved outward 4″ and traced. The tracing then looked like that of a man who had been sliced from head to foot, antero-



The outline on the curtain.

posterially, and both parts moved apart 4″. Instead of stopping at this point the posterior, or back outline, was again moved out 4″ and traced. As the traced outline now appears on the curtain, there is one tracing of the anterior of the standard, or norm, and two tracings of the posterior, with the first posterior tracing just 4″ apart from its original position, and the second tracing 4″ from the first posterior outline. The instep of the foot was not traced as other methods of measuring the foot are used. The outline instead was continued downward. By experimenting it was found that all subjects in the college could fit into the outline as described above. Several outlines were made before the proper dimensions were found. Needless to say, if girls of college age

are used an outline using perfect posture for women would be necessary.

This study is limited to boys of college age, but the principle would remain the same regardless of the age or sex of the subjects used.

HOW THE STANDARD IS ADJUSTED

The question naturally arises, how can the outline, or the norm, be adjusted to all subjects? First of all, the outline is attached to a roll like the curtain in any window. The roll then can be moved up and down to care for variations in height. The range of height of the subjects was from 6′ 4″ to 5′ 2″. The outline easily moved up and down to meet these requirements. As there are no feet on the outline, the outline of the legs was continued downward. Therefore, variations in height could be met. The next problem that naturally arises is caring for the variations in width. The weight of the subjects varied from 220 pounds to 118 pounds, yet the outline could be adjusted to meet these variations. If the subject was of the thin type the inside outline was used while if he was of the stocky type then the outside outline was used. The anterior portion of the outline was used for all subjects, while in the case of the posterior, if a thin person was to be measured, the outside outline would be covered by a strip of black cloth. It will be remembered that there are two posterior outlines. If a stout person is used then he of course covers the inside outline himself so there is no need of covering that line. As will be described under the technique of taking the picture, one spends a little time moving the curtain up and down and removing the strip. With a little organization this may be cut down so the time spent is negligible.

PLACING THE CAMERA

The camera must be placed at such a distance from the image that the image is in clear focus. The distance is determined by opening the shutter in the lens and looking at the ground glass plate in the back of the camera. By moving the camera back and forth and adjusting the bellows focus a clear inverted image may be seen on the glass. When the image is clearest and when it is all visible on the glass, then the correct focus has been obtained. This will be approximately 8 to 10 feet from the subject.

PLACING THE LIGHTS

The number of lights used and the placement of the lights varies. Some use more lights than others. Naturally the length of the exposure depends on the number of lights used, the type of lens, and the stop opening used. The same results may be obtained in various ways. The method used here is one of several possible methods. Satisfactory results may be obtained by using two No. 2 photoflood lights shining from an angle of about 45 degrees and a few feet in front of the camera.

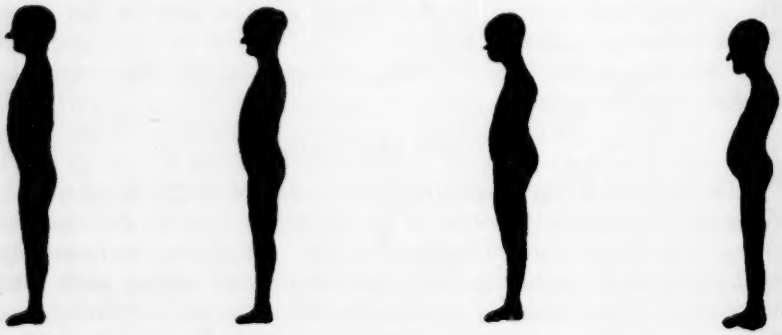
Care must be taken that there is no light allowed to escape from the reflectors and shine back into the camera. There are no other lights, either in back of the curtain or in front with the possible exception of the ordinary room light.

HOW SUBJECTS ARE IDENTIFIED

It would be difficult to identify the individuals from their pictures if some method of numbering them were not possible. A simple method of numbering the pictures and one that can easily be applied is to take three strips of paper and paint the numbers from one to ten on each strip. It is wise to paint the numbers inverted, or as they would appear in a mirror, because they will be inverted in the picture and come out as they should, not backwards. Now glue each end of the strip to a round stick and wind it up. A frame may be made with an opening just large enough to allow one number of each strip to appear. As the rod is turned the numbers will appear in succession. There are a total of 999 numbers on this simple contrivance.

TAKING THE PICTURE

With the apparatus set, the subjects are called in to be photographed. The first subject stands on a little platform that is about four inches high. On the top of this platform are painted footprints on which the boy stands in the nude. The curtain is then lowered to the desirable height. The boy is slim so the strip is left pinned over the outside outline. The subject is now told to move a little forward or a little backward until the outline can be clearly seen on all sides of him. If he was in this position originally he would be asked to hold the position and his picture would be taken. The exposure is about three seconds with the largest stop opening. As each individual steps down from the platform he signs his name on a piece of paper opposite the same number that appeared on the screen. Before stepping up on the platform each boy turns the number chart to the next number. The



Standards of posture (without the outline).

next subject should be a boy who is about the same size and build as the boy before him. By doing this many pictures can be taken without moving the screen. When the stout boys come along, the strip is merely removed and only a few changes in height are necessary. Sometimes only a few adjustments are necessary in a whole class if they are of about the same general size. To make adjustments a boy may be stationed at the curtain, raising and lowering it according to the instructor's directions. With a little experience a whole class may be photographed with but one change made in the width and but a few changes made in the height.

The difficulty might arise that some boys have longer legs than bodies, while other boys have longer bodies than legs. How does the standard on the screen fit them all? The standard on the screen is not intended to fit the individual nose for nose, chin for chin, knee cap for knee cap, etc. Naturally individuals vary in body proportions, but the characteristics of good posture remain the same. It is easily seen whether the individual follows the general contours of the outline even if his knee cap is a little higher than that of the outline. If for instance a boy with good posture was on the platform and the standard, or outline, was raised so that it was a little higher than the boy, it still would be easy to see that the boy followed the general contours of the outline even though point for point he did not line up exactly opposite the outline. It has been found that when one important point on the subject and outline are lined up correctly the other points are so nearly lined up that little difficulty is experienced in noting any deviation from the general contours of the standard.

The pictures are taken on 5″ x 7″ bromide paper, four pictures to one piece of paper. There is no negative to be redeveloped as the picture comes out on the original paper. The cost is less than one cent each. Besides taking an anterior-posterior view of the subject, a picture of the back is also taken. However, this study is interested primarily in anterior-posterior posture so a discussion of the other aspect will not be included at this time.

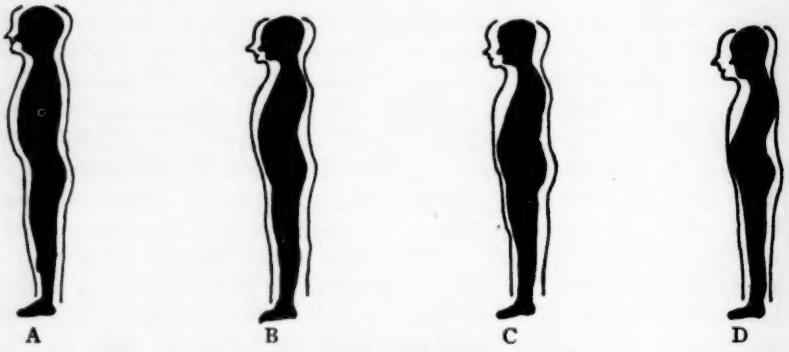
DEVELOPING THE PICTURE

The pictures are developed like any other pictures. The paper is removed from the slides in a dark room and placed in a tray of developer. When the picture is developed sufficiently it is removed, rinsed, and placed in the hypo to set. From here it is again rinsed and placed on a towel to dry. The whole process takes but a few minutes and can be done by anyone. After the pictures are dry they are cut apart, as there are four pictures on one piece of paper.

GRADING THE PICTURES

Using the outline as the standard of comparison rather than the old method of using one's own mental standard which has been proven

very faulty, the pictures are graded according to any deviation from the outline. For instance a hollow back would show more space between the back of the outline than between the outline and other parts of the body. In excellent posture the outline would be about the same distance away from the picture all around. Any deviation from this could be detected in a glance. A protruding abdomen might protrude outside the outline if it were bad enough, while winged scapular might protrude past the outline in the region of the shoulders. The boys themselves get great delight from inspecting their own pictures and have little difficulty in noting their own faults. With the standard before



Standards of posture (with the outline).

your eyes there is little question as to whether the back is hollow or not, whether the abdomen is protruding, whether the head is forward, chest flat, shoulders round, or whether there exists a combination of any of the above defects. Regardless of who is doing the judging an abdomen that is out beyond the outline is a protruding abdomen, and likewise if there is much space between the hollow of the back and the outline at that point then the subject has lordosis.

THE VALIDITY

To determine the validity of measuring posture by means of the Comparograph, seventy-six judges were used. They were instructed to grade ten silhouettes of known value and to give each a rating of either A, B, C, or D based on their opinion after a visual inspection. The silhouettes were shown one at a time and each grade recorded before the next silhouette was shown. Although the same silhouettes were shown on the second test they were shown in a different order. The process was then repeated using the outline with each silhouette. On this second test the judges were instructed to use the outline as the standard of comparison rather than their subjective judgment. The results of this test showed that the judges were able to increase their accuracy by 46 per cent by using the outline. After a lapse of eight

weeks the two tests were repeated and this time the judges increased their accuracy by 49 per cent, or, an average increase of 47.5 per cent over the old method.

THE RELIABILITY

To determine the reliability coefficient of the Comparograph, a judge was asked to grade 50 silhouettes of known value and to give each a rating of either A, B, C, or D. The test was then repeated using the same 50 silhouettes. From the results of these tests a scattergram was made which showed the grade the judge gave the same silhouette on each test.

The actual reliability coefficient was determined by means of the mean square contingency. This showed that C was .79 and correcting this for broad categories it was raised to .91.

To check this the whole test was repeated with another judge. The results on this second test showed that C was .79 also, and correcting it for broad categories it was likewise .91.

A third test was conducted with a new judge. The results of this third test showed C to be .76 and correcting it for broad categories it was .88.

From this four way scattergram it would have been impossible to obtain a "C" reliability coefficient above .89.

SUMMARY AND CONCLUSION

Earlier in this report it was stated that a method of grading posture would be discussed that not only would increase the validity and reliability of the present method, but was also time saving and economical. These conditions have been fulfilled as the Comparograph has increased the validity over the subjective method by 47.5 per cent, and has a reliability coefficient of .79, which when corrected for broad categories is .91. The cost of taking the picture is practically negligible, while the time involved is far less than many of the other methods used.

The Comparograph can be used by the expert or the novice with equal efficiency. As no intricate apparatus is necessary and as no complicated methods of determining the subjects' scores are required, the Comparograph is a simple method of grading posture that can be used in almost any school, especially those that are already using the silhouetteograph.

The Comparograph is adaptable to both sexes and to subjects of all ages. Naturally a standard of excellent posture for the particular group that is to be examined will be necessary.

A Study of the Standardization of Exercise For Use in the Pulse-Ratio Test

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Department of Physical Education
Field Kindley Memorial High School, Coffeyville, Kansas

UP TO the present time stool-stepping has been used exclusively as the standard exercise in the pulse-ratio test. The extensive use of this test for rating physical efficiency, endurance, present condition, and the detection of non-compensated organic heart lesions makes a wider range of standard exercise desirable. With this idea in mind, the present investigation was carried out.

The requirements for an exercise suitable for the pulse-ratio test are (1) simplicity, (2) controllability, and (3) uniformity of body movements. Although there are many exercises which meet these requirements, rope-skipping was substituted for stool-stepping in this investigation. Although it is recognized that the former exercise cannot be performed as universally as the latter, yet it occurred to us that rope-skipping might be as applicable to the situation as stool-stepping.

The pulse-ratio technique furnishes an adequate method for the standardization of any exercise since it furnishes a natural check on the intensity of the exercise. The method of standardization consists of following the stool-stepping technique, except for the substitution of a different exercise.

THE TECHNIQUE

Briefly, the standardization technique is as follows: An individual performs a light exercise, twenty stool steps per minute for one minute. This is followed by a more strenuous exercise, usually forty stool steps per minute for one minute. A pulse-ratio is calculated for each exercise performed immediately after the exercise. This is done by dividing the total pulse for two minutes immediately following the exercise by the resting pulse for one minute. It was assumed and proven that the response of the heart to exercise of graded intensity varies directly with the severity of the exercise, and that the relationship is rectilinear. This was demonstrated by having the subject perform an intermediate exercise, thirty stool steps for example, and comparing the experiment ratio resulting from this exercise with the calculated ratio for the same exercise.[1] The results showed that the experimental and calculated

[1] W. W. Tuttle and Geo. Wells, "The Response of the Heart to Exercises of Graded Intensity," *Arbeitsphysiol.* 4 (1931) 519–526.

ratios were the same, within the error of pulse counting, and thus the exercise-heart-rate relationship was established as far as stool-stepping is concerned.

In order to prove the validity of rope-skipping, or any other exercise as a standard exercise, the procedure described is followed, except the exercise to be investigated is substituted for stool-stepping.

Naturally, different exercises require modifications of technique in performance. Where stool-stepping was used, the act of mounting and dismounting the stool is carried out in a regular cadence, determined by a 1, 2, 3 and 4 count.[2] The individual is seated in such proximity to the stool that when he rises he is ready to begin work. At the count of one, the left (or right) foot is placed on the stool; at the count of two, the right foot is placed on top of the stool thus bringing the subject to an upright position on top of the stool. At the count of three, the left foot is placed on the floor, and at the count of four the right foot is placed on the floor, the individual now being in a standing position ready to repeat the exercise.

The rope-skipping technique is carried out in regular cadence, as in the case of stool-stepping. However, there are only two counts to each skipping cycle. The subject is seated in such a position that when he rises he is in a position to perform the work. At the count of one, the left (or right) foot is driven over the rope, and at the count of two the right foot trails over the rope and both feet come to rest on the floor. This constitutes one cycle or skip. As is practiced in stool-stepping, a metronome may be used to pace the subject, by setting the bell for a two instead of a four-cycle count.

In place of a stool 13 inches high, a standard one-quarter-inch jumping rope with adjustable handles was used. Each subject adjusted the length of the rope to fit his jump.

In the experiment, three exercises of different intensities were used. The light exercise consisted of twenty skips per minute for one minute, while the strenuous exercise was forty skips. An intermediate exercise of twenty-five skips was also performed.

In order to test the validity of rope-skipping as a standard, controllable exercise, the procedure was the same as that described for stool-stepping. It was logical to conclude that if experimental and calculated ratios for the intermediate exercise coincided within the limits of pulse counting errors, rope-skipping is as reliable for standard exercise as stool stepping.

THE DATA

Data were collected from forty-eight normal men, ranging in age from seventeen to thirty-five years. A summary of the data is shown in Table I. In the column marked "twenty-five skips," the experimental

[2] W. W. Tuttle, "The Use of the Pulse-Ratio Test for Rating Physical Efficiency," RESEARCH QUART. 2 (May, 1931) 5–17.

TABLE I

A Comparison of Experimental and Calculated Pulse Ratios Obtained from Three Rope-Skipping Exercises of Different Intensities

Subject number	Resting pulse 1 min.	Twenty skips 2 min.	Twenty skips pulse ratio	Forty-skips 2 min.	Forty-skips pulse ratio	Twenty-five skips pulse 2 min.	Twenty-five skips exp. ratio	Calculated ratio	Difference
1	74	191	2.58	220	2.97	198	2.69	2.68	.01
2	73	165	2.32	185	2.57	171	2.38	2.39	.01
3	72	166	2.30	195	2.70	173	2.43	2.41	.02
4	82	186	2.27	217	2.65	194	2.36	2.36	.00
5	68	152	2.24	184	2.66	160	2.35	2.34	.01
6	80	171	2.14	199	2.45	179	2.24	2.23	.01
7	52	111	2.13	139	2.67	119	2.30	2.28	.02
8	72	153	2.13	184	2.41	161	2.24	2.20	.04
9	63	137	2.17	165	2.62	143	2.27	2.28	.01
10	72	149	2.07	178	2.47	157	2.18	2.17	.01
11	62	141	2.27	169	2.69	150	2.39	2.36	.01
12	75	159	2.12	188	2.50	167	2.22	2.22	.00
13	61	141	2.31	171	2.80	148	2.42	2.43	.01
14	60	138	2.30	167	2.78	146	2.43	2.42	.01
15	79	174	2.20	203	2.57	182	2.30	2.29	.01
16	80	166	2.07	195	2.43	174	2.18	2.16	.02
17	84	192	2.28	222	2.64	201	2.39	2.37	.02
18	95	210	2.21	241	2.53	218	2.30	2.29	.01
19	78	181	2.32	211	2.70	190	2.43	2.44	.01
20	68	162	2.38	190	2.79	171	2.51	2.48	.03
21	74	153	2.06	181	2.44	162	2.19	2.16	.03
22	88	156	2.29	188	2.76	163	2.39	2.41	.02
23	94	209	2.22	240	2.55	218	2.32	2.30	.02
24	80	174	2.18	205	2.56	184	2.30	2.28	.02
25	78	181	2.32	212	2.71	191	2.45	2.42	.03
26	88	185	2.10	214	2.43	193	2.20	2.18	.02
27	79	165	2.09	196	2.48	176	2.23	2.19	.04
28	80	166	2.07	197	2.46	175	2.19	2.17	.02
29	76	157	2.06	186	2.44	167	2.20	2.16	.04
30	66	140	2.12	169	2.56	150	2.27	2.23	.04
31	60	138	2.30	174	2.90	149	2.48	2.45	.03
32	78	174	2.23	222	2.84	188	2.42	2.38	.04
33	94	196	2.08	245	2.61	209	2.22	2.21	.01
34	80	180	2.25	224	2.80	193	2.41	2.39	.02
35	76	160	2.10	198	2.60	172	2.26	2.93	.03
36	72	166	2.30	200	2.77	177	2.45	2.42	.03
37	60	120	2.13	162	2.70	139	2.31	2.27	.04
38	64	147	2.31	169	2.64	156	2.43	2.39	.04
39	58	146	2.52	164	2.83	152	2.62	2.60	.02
40	71	166	2.34	191	2.69	172	2.42	2.43	.01
41	80	183	2.29	212	2.65	191	2.39	2.38	.01
42	70	150	2.14	172	2.46	158	2.26	2.22	.04
43	80	186	2.33	233	2.90	199	2.49	2.48	.01
44	80	181	2.26	201	2.51	189	2.36	2.32	.04
45	74	171	2.35	195	2.63	181	2.45	2.42	.03
46	86	189	2.20	217	2.52	118	2.30	2.28	.02
47	82	210	2.56	243	2.96	219	2.67	2.66	.01
48	61	134	2.20	183	3.00	145	2.38	2.40	.02
Means	74	161	2.23	199	2.81	174	2.36	2.34	.02

ratios for the intermediate exercise are presented. The calculated ratios for the intermediate exercise are shown in the column so indicated. An examination of the column marked "difference" shows that the mean difference between calculated and experimental pulse ratios is .02, the greatest difference being only .04. These differences all fall well within the experimental range of pulse counting as done in this investigation.

THE CONCLUSIONS

On the basis of data collected from forty-eight normal men who performed the pulse-ratio test using rope-skipping as a substitute for stool-stepping, the following conclusions are drawn:

The fact that the response of the heart to exercises of graded intensities varies directly with the strenuousness of the exercise and that the relationship is rectilinear as shown by the pulse-ratio technique when stool-stepping is used as the standard exercise was also demonstrated using rope-skipping as the standard exercise. This not only demonstrates the exercise-heart-rate relationship but also proves that rope-skipping is as adequate a standard exercise for use in the pulse-ratio test as stool-stepping.

BOOK REVIEWS

PHYSICAL EDUCATIONAL FACILITIES FOR THE MODERN JUNIOR AND SENIOR HIGH SCHOOL. Herbert Blair. (New York: A. S. Barnes and Company, 1938.) 163 pages. Price $2.50.

The purpose of the book as outlined by the author deals with facilities that are provided for the physical education program in junior and senior high schools necessary to carry out an adequate program. Tables and floor plans illustrate the text.

This purpose is well carried out, giving the reader a clear understanding for the proper placement of the gymnasium and all adjacent accessories needed in caring for those using the gymnasium and its facilities. The book is not only valuable to teachers of physical education but also to state departments of education, architects, superintendents, and school board members as well.

The general progression begins with the nature and need for the study, the problem and the methods of procedure. It then goes on to tell how to measure the physical education facilities, score cards and diagrams for measuring, and in conclusion reasons for differences.

In provisions for the physical education program diagrams are shown for the number of showers for girls and the size of gymnasium classes, types of showers, departmental offices, location of the gymnasium, light for the gymnasium, bleachers, apparatus and storage rooms, boys' dressing rooms, boys' and girls' shower rooms, team rooms among many others too numerous to mention.

The book has taken four states, Massachusetts, New York, New Jersey, and Pennsylvania, and the author, through intensive study in these states, has worked out tables to compare the facilities of physical education in these various states.

After reading the book, and studying the charts, one feels that just about everything has been covered.

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GRADED LESSONS IN FUNDAMENTALS OF PHYSICAL EDUCATION. Gertrude M. Baker, Florence M. Warnock, Grace D. Christensen. (New York: A. S. Barnes & Company, 1938.) $3.00.

This outstanding contribution to elementary school education was developed when the authors as instructors at the University of Minnesota took over the entire physical education program of a six grade Minneapolis public school for two years. Many of the theories thus put to the test had their inception with a group of progressive middle-west women physical educators working on the concept of "fundamentals" about nine years ago.

The elementary school is accepted as the cradle of tool learnings in academic subjects. Just as the fundamentals of language arts are given the child to prepare him for present and future communication needs so too should fundamentals of movement arts be given him to prepare him for present and future health and recreation needs. The term "fundamental" is used because the authors wish to stress those skill factors of balance, timing, force and direction or accuracy which are basic to the control of an object or the body itself.

This progression of fundamentals in traditional and well known activities from grade to grade is so well built up that the momentum it gains makes for

inescapable imprint of skills, habits, knowledges, controls and attitudes. For me, too-long schooled in formalism, this is the only usable elementary curriculum I've ever seen which at once answers my conflicting demands. It harnesses so gently and firmly the moot progressive approach with an unusually clear cut logical procedure.

The work of the six grades is arranged in such units as:

Playground games for repertoire and self-direction.

Fundamentals of ball skills for control of an object.

Fundamentals of balance and direction applied in self-testing activities, posture and games.

Fundamentals of rhythmic activity applied in free rhythms, folk dancing, rope skills and tumbling.

Review of all fundamentals in old or new situations such as a Play Day.

Basic principles of health integrated with motor activity throughout all units.

Lesson planning follows that generally accepted in educational circles but is couched in terms so specifically planned that inexperienced and even inadequately trained teachers of physical education should be able to adapt every lesson readily to his own situation no matter what it may be.

Probably the best way to demonstrate the clarity and comprehensiveness of these many lesson plans is to let you read two chosen at random.

Grade I

Fundamentals of Ball Skills

Lesson 17

Major Objective: Ability to throw a volley ball at a moving person.

Minor Objective: Ability to recognize that today's games are more fun if everyone thinks about safety.

Activities

1. Demonstration of how the ball is thrown in today's games.

Discussion of avoiding scaring or hurting person in center by keeping ball well away from his face.

2. Two circles, simple "Dodge Ball" with only one in the center of the circle. Volley ball is used.

3. Huntsman.

Outcomes

1. Knowledge.

Ball must strike below the waist because everybody has more fun if no one is frightened or hurt.

2. Skill—Ability to:

a. Form circles without help.

b. Look at "It's" feet, legs, or knees before throwing the ball.

c. Swing the ball toward "IT" to make it go all the way.

3. Organic stimulation.

Knowledge.

Recall of safety rules used in tag games played.

Grade IV—Fundamentals of Rhythm

Lesson 45

Major Objective: Ability to show two phrases originating ball activities and combining them wtih body movement.

Minor Objectives: Ability to respond to even and uneven rhythms with suitable activities.

Activities

1. Come Along. Respond with suitable activity to rhythm set by tom-tom. When the beating stops, run for a vacant place in the circle.

2. Originate ball activity; combine it with a body movement. (O'Leary type of activity.) Children work independently. Demonstrate in front of own squad. Squad selects its best activity for demonstration to whole group.

3. Broom Dance—Variation. Recall from previous lesson.

Outcomes

1. Skill—Ability to:

a. Respond with suitable activity to the accompaniment.

b. Quickly look for vacant place when music stops.

2. Skill—Ability to:

a. Show two phrases by a change in ball activity and body movement.

b. Combine invented ball activities with invented body movement.

3. Skill—Ability to:

a. Show change in phrase in time with music.

b. Respond with proper activity.

There are complete lessons planned in this detailed way to cover two twenty minute periods each week for the school year for Grades I through IV and two thirty minute periods per week for the school year for Grades V and VI as well as suggested procedure for adaptation of the curriculum to other time arrangements.

For curriculum users there is packed in this book enough material to make it almost a one volume Complete Code. For curriculum creators I'd say this has not only the germ of a thousand and one courses of study but progressive method and neuromuscular skills beautifully graded and interlarded so neatly with attitudes that even the most cynical must reach avidly for it.

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Young Women's Christian Association
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BADMINTON TIPS. Carl H. Jackson and Lester A. Swan. (Detroit: Sport Tips and Teaching Aids, 16801 Parkside Avenue, 1938.) Loose leaf book of fifteen 8½ x 11 charts, $3.00. (Combined with wall charts, $5.00).

As in most racket games it is difficult to present word pictures of the fundamentals of badminton. Carl H. Jackson and Lester A. Swan have published in most convenient form a series of excellent charts depicting such pertinent phases of the game as the grip, the services, the bird flight, the strokes, net play, foot work, doubles teamwork, etc.

The illustrations, accompanied by concise but adequate explanations, are clearly presented in vivid white line drawings on a black background. These excellent drawings, accompanied by the descriptions, should be of great assistance to players and instructors. The subjects are so classified upon the 8½ x 11 plates that one may use a specific card for presenting a certain division of the game. After the discussion period is over the charts may be conveniently hung upon the gymnasium wall or a bulletin board for further study.

The authors have also prepared four large wall charts which include all of the plates. This type of chart is always worth while when placed in a game room where it may be consulted by participants when the instructor is not present.

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TEACHABLE MOMENTS (A New Approach to Health). J. B. Nash. (New York: A. S. Barnes and Company, 1938). $1.50.

Those who have had the pleasure of hearing Dr. Nash give one of his inspirational addresses will immediately recognize the usual Nash drive, follow-through, and approach, in this his newest contribution to health. The subject is highly dramatized and is so cleverly treated that those who have been used to reading the average run of literature in the field of health will find in this book a source of inspiration as well as enjoyment.

There is no lost motion to be found in the book. It is presented in a direct and simple manner, so that anyone may read it understandingly, without the aid of an encyclopedia or a knowledge of physiology. In short, it is made up of plain statements and principles based on physiological experimentation. Much of the material used in Nash's addresses will be found in this book. He has freely quoted from poets, writers, and statesmen to illustrate his points. Such challenging statements as "Life is a dance over fire and water," by Elie Faure, and "I see one-third of a nation ill-housed, ill-clad, ill-nourished," by President Roosevelt, are characteristic of the headings of each chapter.

When asked why he wrote the book when there were already hundreds written on kindred subjects, the author replied that "health has never been treated in terms of language understandable to school administrators, teachers, parents, and older boys and girls." In other words, while others have literally torn the individual to pieces in treating of the mind, body, and soul, to say nothing of hundreds of specialists that treat the ear, eye, nose, throat, etc., Dr. Nash brings us the study of the individual as a whole: the organic and feeling phase, all in unity.

In the chapter "The Home Sets the Pattern," Dr. Nash has developed the following objectives which are carried through the chapters on the school and community: remove infectious drains, eliminate strains, promote wholesome, health habits, and build power for health through use.

In the beginning of the book, Dr. Nash points out the seven challenges to our civilization as found by the Technical Committee on Medical Care. These challenges come from families on relief or of low income. The study shows that millions of people are actually living below par physically and mentally because of illness or disability. A great number of these unfortunates are still "on the job" and have not consulted physicians nor have they had the opportunity of hospitalization. They are dragging along from day to day, inefficient in their work and unable to enjoy leisure, and consequently they hasten to an early death.

This theme is developed around the needs of the home, school, and community, and what can be done to aid in the prevention, as well as the cure, in regard to the challenges to our present civilization which the Technical Committee on Medical Care pointed out.

In the chapter "Teachable Moments," Nash observes that there are at least four important moments in the life of the individual:

1. When a child exhibits curiosity.
2. When a child feels that differences make him conspicuous.
3. When the adults are scared.
4. When parents want something better for their children.

The chapters on the home, community and school are especially well treated. The topic of health is summed up as follows: "In addition to, and above all else, buoyant health depends upon the will to live. When the individual can look toward tomorrow with anticipation, we may say 'Power is added unto him.' Hence, will the years be added to each life, free from drudgery and what is more: years of healthful, happy living."

According to the author: "The book is a treatise by a layman, directed to laymen and produced at the request of laymen." The reader will find a new point of view in *Teachable Moments —A New Approach to Health.*

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APPLIED PHYSIOLOGY OF EXERCISE. Ferd John Lipovetz, (Minneapolis: Burgess Publishing Company, 1938) 293 pages, mimeographed, $3.25.

One of the weaknesses in most undergraduate curricula in professional training schools has been the applied science laboratory courses. In attempting to overcome this weakness, the present volume has been worked out by a physical education specialist, who is also much interested in the application of the basic science courses to their respective roles in physical education and its allied fields.

The author has divided the material into two sections. The first is the "General Theory," in which the phenomena of muscle contraction, the chemistry of movement, body equilibrium, postural tonus, the nerve mechanism, chemistry involved in nerve reactions, and the control of nerve reactions are systematically and fully discussed.

The second part has been called "General Practice" which is a classification and comparison of exercises which make up the "core" of a physical education curriculum. This section is "intended to focus thought and study on the practical aspects of physiology of exercise (and) does not attempt to leave out theory essential to a better understanding of the problems outlined."

The main emphasis of Section Two is on giving an adequate background to teachers of health, physical education, and recreation for adapting activities to the needs of the individuals with whom they come in contact in their teaching. "To know the characteristics of child, youth, and maturity; to know the effects upon the human body of the various physical education activities and to know some of the testing methods whereby these facts can be ascertained and judged are fundamental and practical aspects of the unsolved problem" of adapting activities to needs of children, youth, and adults.

Laboratory experiments for use in professional training classes are suggested in this part. The student would have an excellent background for corrective, as well as preventive, activities, and an ability to assist in developing activity schedules to meet individual needs upon the completion of a course using this book as a text.

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PHYSICAL EDUCATION ACTIVITIES FOR GIRLS IN JUNIOR AND SENIOR HIGH SCHOOL. Theresa Powdermaker. (New York: A. S. Barnes and Company, 1938) $3.00.

This is a source book for women graduates of physical education as they prepare for their first year of teaching. The material is condensed so that it may be referred to quickly and easily. The activities are intended primarily for the average junior and senior high school girl and no activities of great skill have been included.

Suggestions in the organization and administration of the physical education program include class and squad organization, program activities, intramurals, playdays, tests, grades, excuses, costumes, and athletic associations. The author has listed thirty points of advice for new teachers which should prove particularly helpful.

The four chapters dealing with activities are headed respectively: "Self-testing Activities," "Games," "Coaching Hints and Technique for Game Skills," and "Swimming."

This text includes a wealth of materials and teaching suggestions presented in such concise form as to make it a valuable reference for teacher of girls' physical education in junior and senior high school.

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HEALTH GUIDES AND GUARDS. Francis P. Wall and Louis D. Zeidberg, M.D. (New York: Prentice-Hall, Inc., 1938) 380 pages, $1.40.

This revised and enlarged edition justifies the expectations of those who appreciated the original, published in 1936. The chief differences noted are the addition of thirteen chapters (120 pages) on community hygiene, which now constitutes Part II of the text, and additional emphasis upon the dangers of gonorrhea, syphilis, and chancroid, for which the term "venereal disease" is still retained.

Despite the apparent assurance of the authors that "social diseases" should be given a place early in the consideration of hygiene, there are many who feel that this topic would be treated more effectively towards the close of a course, during which an opportunity is given the instructor to establish a needed understanding between himself and his students before treating this most important aspect of a delicate subject.

There appears to be a tendency to appeal on the basis of fear by frequent strong statements concerning the results

of certain diseases or conditions. In general, however, the text contains a commendable selection of topics from the entire field of hygiene and the treatment is suited to an elementary class, though there is something of a leaning towards a medical rather than a lay point of view.

In makeup the text is attractive, clear type of adequate size, with emphasis by italics or bold-faced type. Short sentences and paragraphs, a fair index, and at the end of the text true-false and essay type questions on sheets perforated so as to be removable add to its value.

One wonders why in the diagram of the circulatory system (page 11) the ventricles are represented as located *above* the auricles.

G. B. Affleck
Springfield College

Your Chest Should Be Flat. S. A. Weisman, M.D. (Philadelphia: J. B. Lippincott, 1938), 145 pages, $2.00.

People commonly believe that the structure of the chest should be round rather than flat, and hence efforts in physical education have been toward the development of the round, high type of chest. That this belief is fallacious has been proved by the research on more than twenty thousand people reported by Dr. Weisman in the book, "Your Chest Should Be Flat."

Determinations of the thoracic index (the ratio of the depth to the width of the chest) indicate that the round type of chest is more often associated with poor body development and tuberculosis than is the flat type, and that the shallow appearance of the tuberculous chest is merely a postural illusion. "The deep chest makes better soil for tuberculosis," says Dr. Weisman.

The normal thoracic index for an adult varies from .66 to .7, showing that the depth of the chest is about two-thirds the width. An infant is born with a round chest which gradually flattens into the elliptical adult chest. Weisman emphasizes the fact that 87 per cent of this change occurs during the first five years of life. It is important, therefore, that the physical educator aid the child during the years before adolescence with the proper developmental exercises for the muscles within and surrounding the thoracic cage. Ladder and rope climbing, swimming, tennis, baseball, and other outdoor activities are advised.

Studies on children of all ages show that there are slight sex differences in the thoracic index, that environmental conditions are more important than heredity in determining the shape of the chest, and that the vital capacity varies inversely as the thoracic index. The tuberculin test and its significance are explained; individual and community measures are suggested for building defenses against tuberculosis.

The book is enlightening to the layman as well as the physician. The research is extensive, carefully done, and has many practical implications. The physical educator will find material on development of the individual which may be used as a guide in health education classes and in choosing activities for the child.

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Fist Puppetry. David Frederick Milligan. (New York: A. S. Barnes and Co., 1938) illustrated, $1.50.

Fist puppets are not new. In ancient Egypt they were "figures of the gods." In Greece puppets were used as characters in religious dramas. In Europe, they were used in the courts and on the corners of the curbs. The present revival of puppetry is due to the increasing interest in the recreation movement. Fist puppetry seems to be finding a significant place among the cultural and craft activities of school groups, clubs, recreation centers, community and civic theaters, the home, and the hospital.

Mr. Milligan has contributed a complete and worth-while handbook. He tells his readers how to make fist pup-

pets, how to adapt plays, how to make costumes and scenery, how to construct a puppet theater, and how to produce a puppet show. The author's vivid descriptions enable young and old to learn fist puppetry easily.

The school teacher and club leader who uses this book will find that the author has overlooked little. Of particular value is the bibliography of stories and plays, the suggested list of books containing folk lore and legends of foreign lands and the complete index.

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SIDE-SADDLE. Doreen A. Houblon. (London: Country Life Ltd.; New York: Charles Scribner's Sons, 1938), 115 pages, illustrated, 12/6 English, $5.00 American.

Many books written on the forward seat confine their observations to riding astride. Mrs. Houblon has now brought the subject up-to-date for the side-saddle rider. Persons who ride or teach side-saddle should find the material included in this book very useful. Both the foreword, written by Brig. Gen. C. C. Lucas, M.C., and the introduction emphasize the idea that the principles that Mrs. Houblon advocates are not dogmatic, and that they must be applied with reasoned logic. Oldsters need not necessarily change their seats, but the new and advocated seat has been proved good.

Chapter I stresses the idea that the broad principles of riding astride and riding side-saddle are essentially the same. The side-saddle seat is advantageous to women whose physiques do not enable them to have firm seats astride; it has its disadvantages, however, in that the riders are apt to find it so easy to stay on that they will not take time to learn correctly. Also, the position sometimes leads to sore backs for the horse when not correctly learned; the side-saddle is heavier than the astride saddle, and it brings added expense, because it is usually necessary for a woman to own her saddle, and the cost of a side-saddle and habit is greater.

Chapter II discusses seat and position, balance and grip, with clear and complete explanations and illustrations, including saddle design and length of leather.

Chapter III explains the rider's reaction to the walk, trot, canter, and gallop; and discusses rising, including changing diagonals at the trot, and the correct leads at the canter.

Chapter IV deals with the language of the aids; and Chapter V discusses compensating for the lack of right leg in side-saddle, and the more advanced aids and impulsion, including balance and collection. There is a description of a good rider.

Chapter VI explains lateral movements, how they are executed, and their value.

Chapter VII progresses to cantering with given leg leading and changing leads, including compensating for lack of right leg by use of right indirect rein of opposition.

Chapter VIII discusses jumping, including position to use and type of saddle advocated. Chapter IX is a continuation of jumping, with explanations of riding a horse to and over jumps, the approach and placing a horse, and riding horses that refuse.

Chapter X offers sound advice on riding horses with bad habits.

The appendices include explanations and illustrations of mounting and dismounting, gate opening (which is well to learn if one plans to hunt in England) and the fitting of the side-saddle.

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